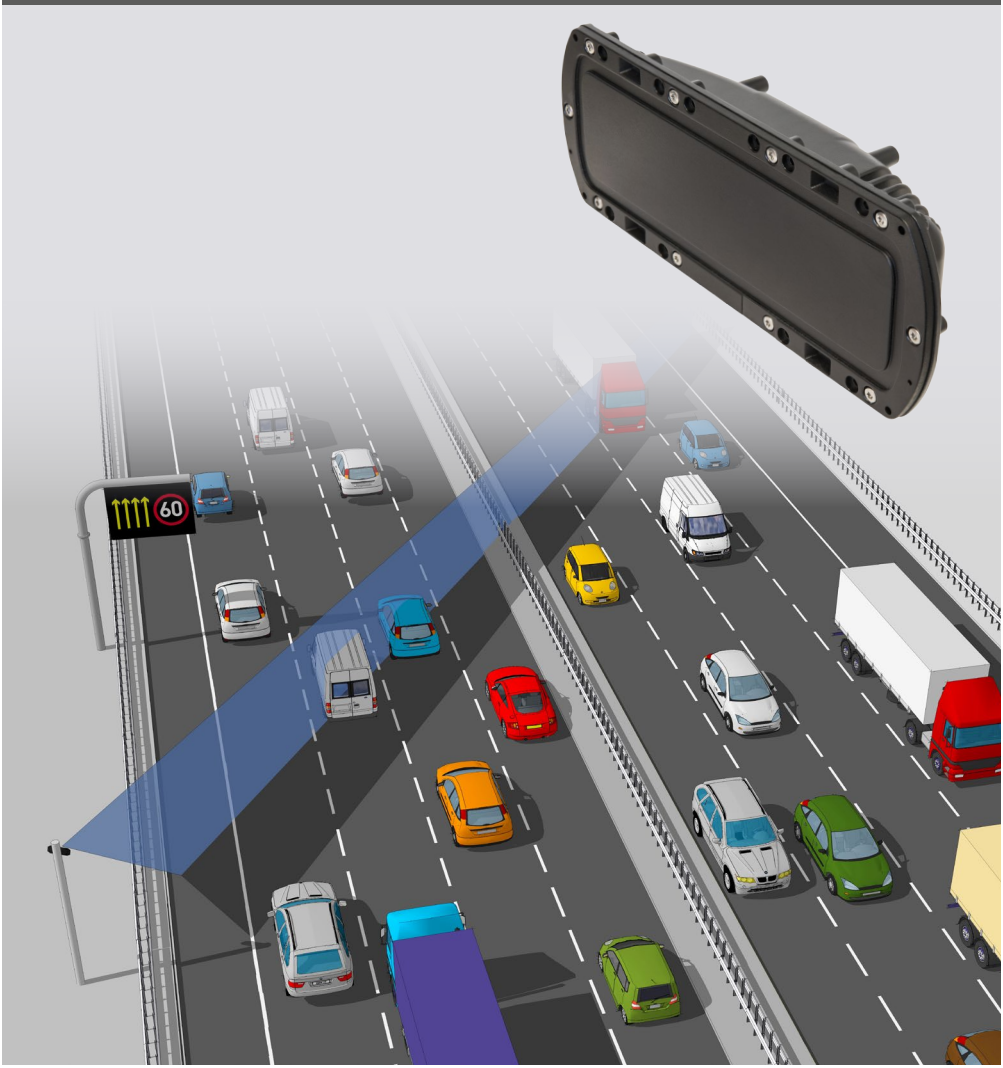
AGD 343

HIGHWAYS MONITORING RADAR

PRODUCT MANUAL



AGD Align

AN AGD TOUCH-SETUP TOOL

AGD

PRODUCT SOLUTIONS FOR
INTELLIGENT TRAFFIC SYSTEMS

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AGD **343**
HIGHWAYS MONITORING RADAR

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AGD **Align**
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Introduction

PRODUCT & TECHNOLOGY

AGD **343**
HIGHWAYS MONITORING RADAR

The AGD 343 Highways Monitoring Radar is an easy-to-integrate traffic flow monitoring solution that provides real-time data on multi-lane highways. Designed for traffic profiling and incident detection, the 343 dramatically enhances highways safety, capability and efficiency.

AGD's 343 employs proven enforcement-grade radar & measurement techniques to quantify speed, range and length of passing vehicles. Detailed traffic information - such as, 'is traffic free-moving, slowing or starting-to-queue?' - is available in all weather conditions to inform control rooms and allow instant decision making.

AGD radar can replace intrusive high-maintenance loops, mounting on existing roadside poles or gantries where it 'looks' across the road at 30 degrees. The additional capability to operate at a ≥ 2-metre offset, while maintaining a 6-metre plus mounting height, ensures reliable operation in managed motorway scenarios and ALR (All Lanes Running) schemes. The 343 has been designed to cope with the many difficulties facing international road network installations.

KEY FEATURES

- Flow monitoring solution for multi-lane real-time data
- Traffic Profiling and Incident Detection
- Ten lane highway capability

- Enforcement grade radar & techniques
- Identifies, tracks & measures speed, length, lane/direction of individual targets
- Multi-level incident detection mode

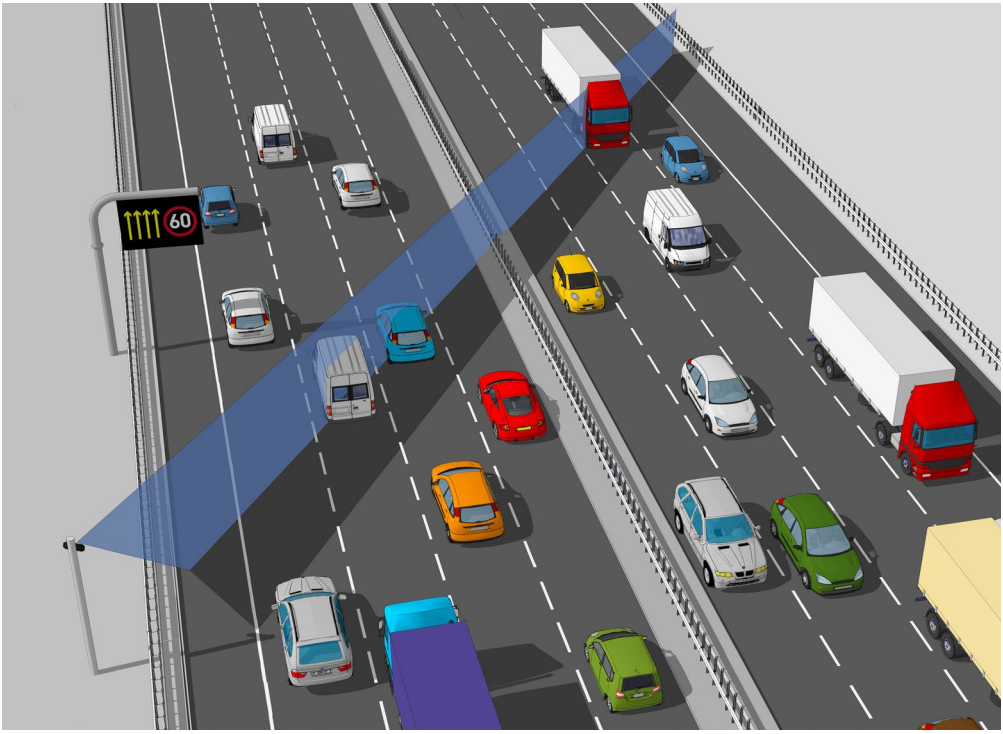
- Non-intrusive loop replacement
- Mounts on existing infrastructure
- Simple to install, setup and configure using AGD Align

Introduction

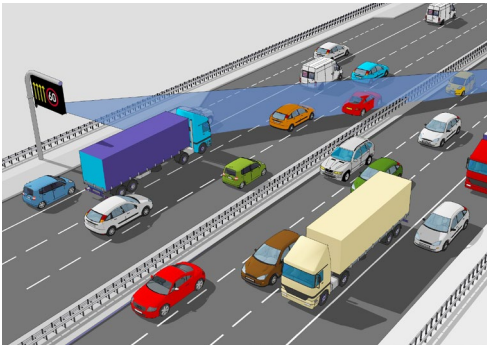
AGD **343**
HIGHWAYS MONITORING RADAR

TYPICAL APPLICATIONS

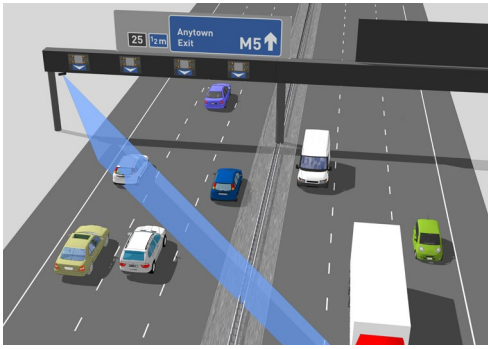
Multi-Lane Highways Monitoring Radar - Dedicated Infrastructure Mounted



MS4 Mounted



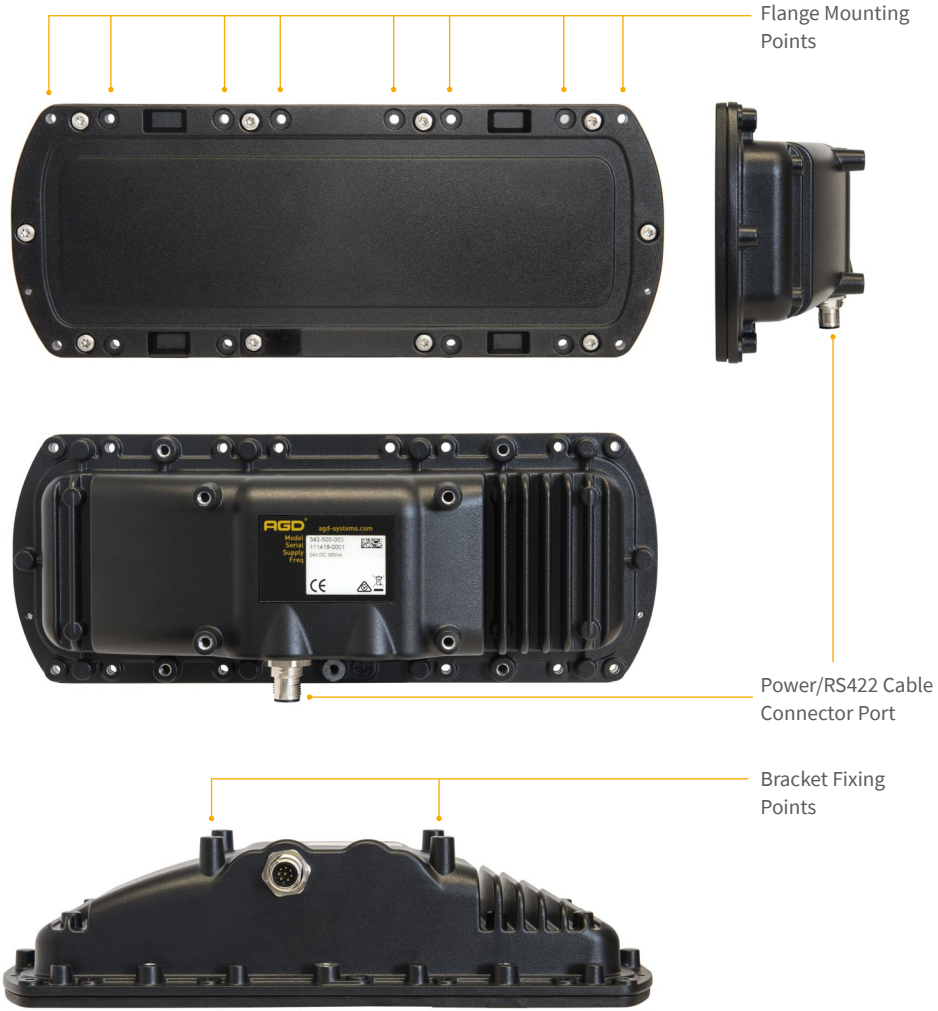
Gantry Mounted



Introduction

PRODUCT OVERVIEW

AGD **343**
HIGHWAYS MONITORING RADAR



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Installation

AGD **343**
HIGHWAYS MONITORING RADAR

INSTALLATION INFORMATION

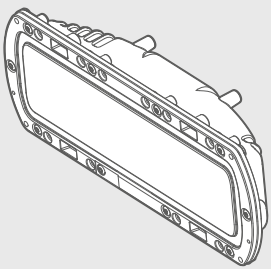
The radar is designed to be mounted to various structures such as a dedicated column, gantry or sign.

To install the radar, the following parts will be required:

No.	Part No	Description	Notes
1	343-500-000	AGD 343 Highways Monitoring Radar	
2	MS-246	343 Mounting Bracket Kit	
3	CA-310	343 Power/RS422 Cable Assembly	
4	MK343-05	Camera Setup Tool	(this is removed after setup)

To provide power and communication interfaces the following parts will assist in detector integration:

No.	Part No	Description	Notes
5	MK343-01	343 Interface Enclosure	
6	MK343-03	343 Interface Enclosure (c/w 24Vdc PSU)	

1


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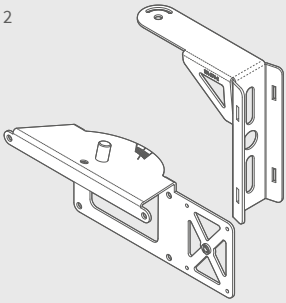

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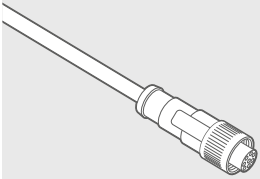

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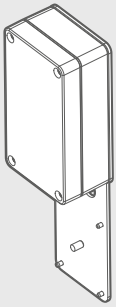

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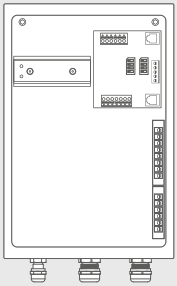

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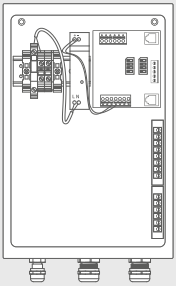


Installation

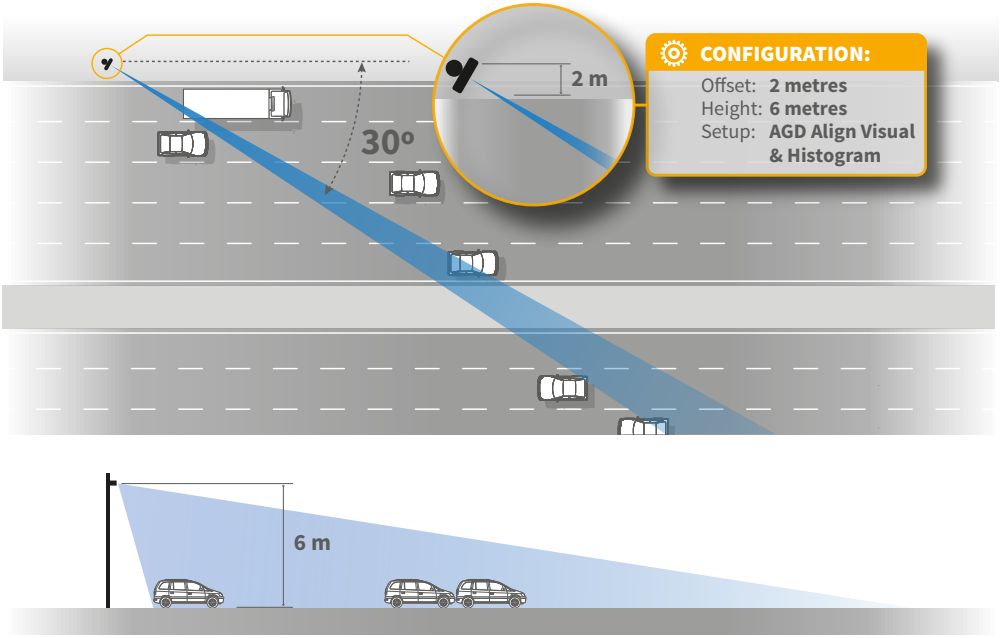
AGD **343**
HIGHWAYS MONITORING RADAR

MOUNTING LOCATION

The AGD 343 has been designed to be mounted on a variety of structures, where it looks across the carriageway at 30 degrees to provide highly accurate traffic data.

The detector must be mounted at a **minimum height of 6m** above the carriageway and at an angle of 30 degrees. The AGD Align set-up tool assists in accurate set up of the angle.

Offset	Recommended Mounting Height	Acceptable Mounting Height
2m	6m	6m



Mounting Location Considerations

The detector has been designed to monitor traffic in inter-urban environments while maintaining resilience to external factors, however, care must be taken when choosing a mounting location.

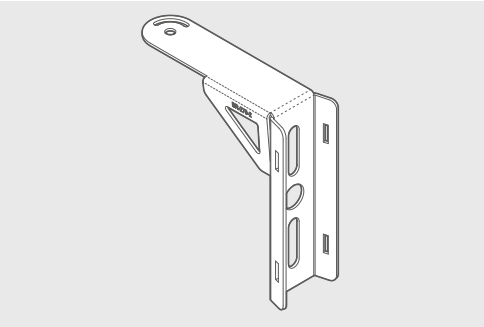
Avoid where possible:

- Installing the detector where it points toward large reflective surfaces (such as signs, barriers and metal retaining walls)

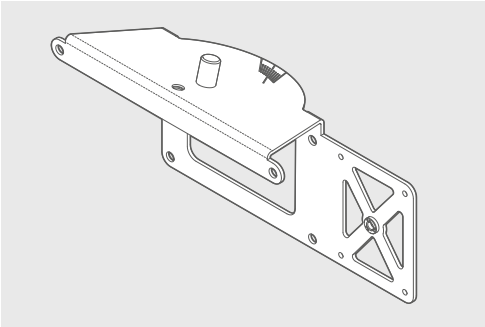
PHYSICAL INSTALLATION

343 Mounting Bracket Kit

The AGD 343 bracket mounting kit (part number **MS-246**) consists of two brackets and all the required fixing hardware.



BR-270 is the component of the bracket kit that fits to the structure you are mounting to.



BR-271 is the component of the bracket kit that fits to the rear of the radar.

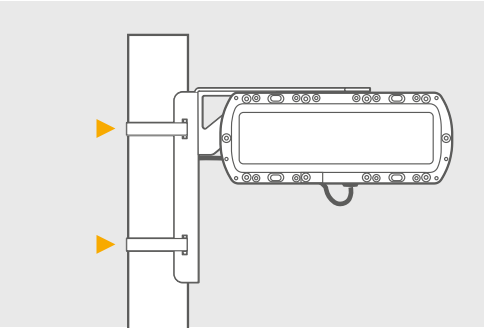
Fixing hardware consists of:

7no. M5 x 10mm Torx T20 A2 Stainless Screws

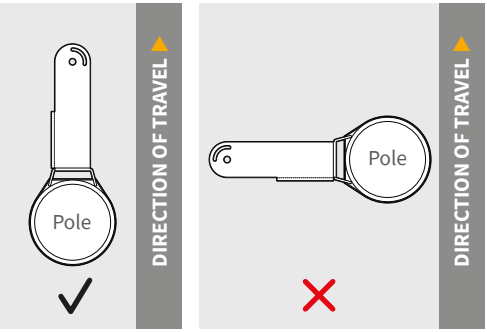
7no. M5 External Shakeproof A2 Stainless Washers

Step 1 – Mount bracket to the pole

Attach BR-270 to the structure you are mounting too using mounting straps (AGD recommends stainless steel sign banding ½" thick).



The position of the bracket should be parallel to the carriageway as in the image below, left. Do not install the bracket as shown in the right hand image.

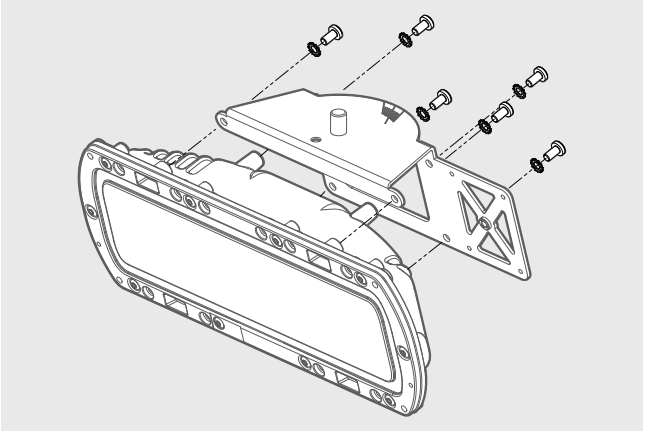


PHYSICAL INSTALLATION

Step 2 – Mount bracket to the radar

Fit the six torx screws and washers and tighten to a torque of 1.2Nm.

Make sure to fit the bracket as shown with the cable entry port of the radar pointed downward and the bracket not obscuring it.

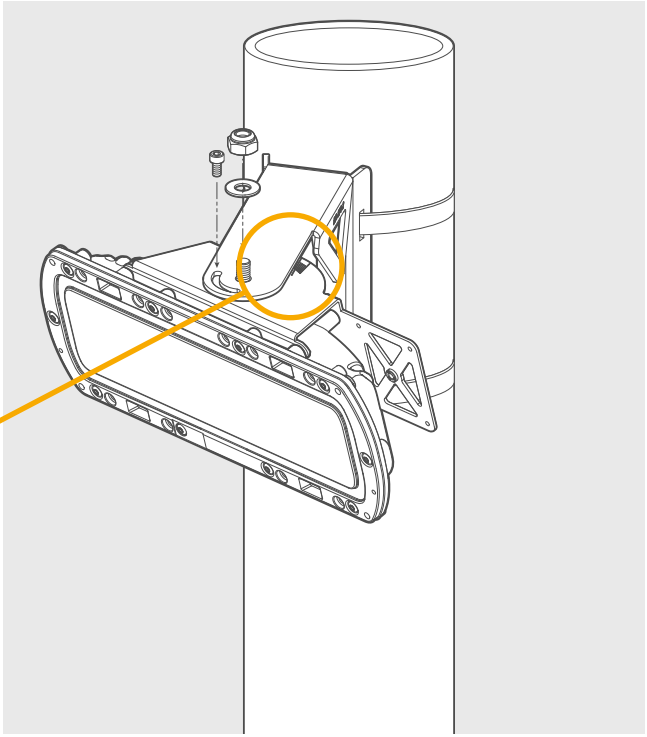


Step 3 – Mount radar to the pole

Insert the M10 Mounting Bolt through the hole in the bracket on the pole, loosely tighten the M10 Nyloc Nut.

Install the M5 locking nut in the slot as shown adjacent to the M10 captive bolt.

Position the radar at roughly 30 degrees to the road, the etched marks on top of the bracket will help with alignment.

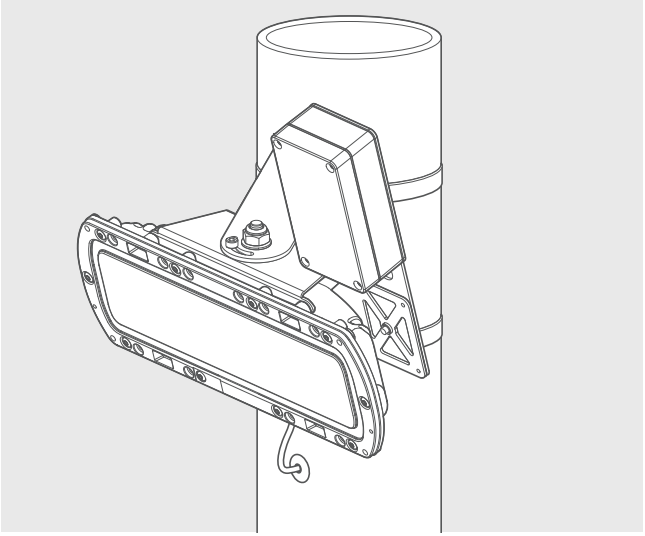


PHYSICAL INSTALLATION

Step 4 – Install cable

Install the cable in a suitable manner down through the pole by drilling and always inserting the cable through a suitable grommet.

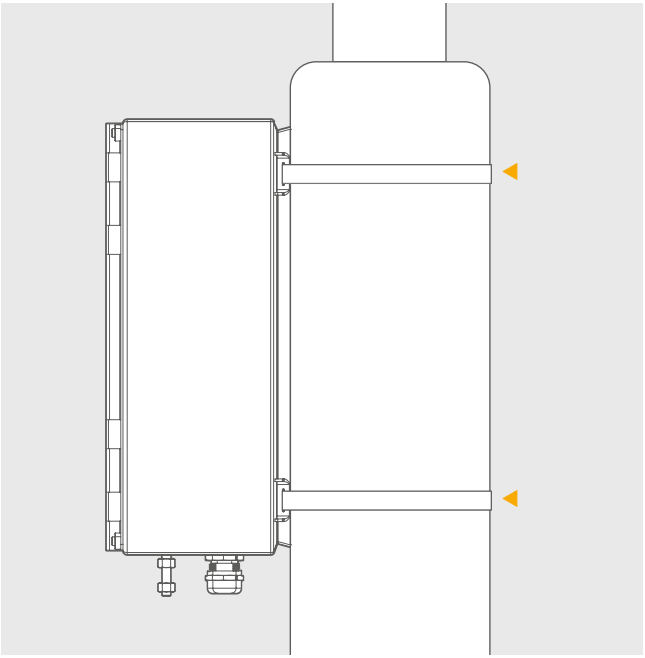
Connect the cable to the cable entry port on the bottom of the radar.



Step 5 – Install MK343-03 Interface Enclosure (c/w 24Vdc PSU)

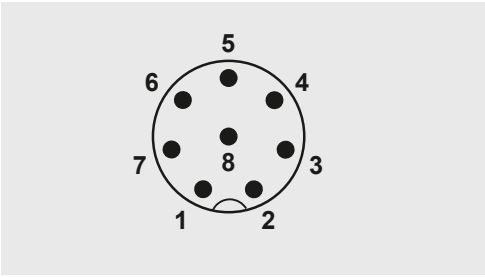
Using the same method that was used to mount the radar bracket to the pole, mount the interface enclosure using stainless steel banding.

The box has an IP56 rating.



ELECTRICAL INSTALLATION

The detector is powered using a 12-24Vdc supply. The power is applied to the detector using the multi-pin mating connector.



The product mating connector is shown above and is located on the bottom of the product.

CONNECTIONS			
Pin No.	**Associated wire colour**	**Function**	**Additional Notes**
1	White	GND (0v)	
2	Brown	GND (0v)	
3	Green	Y (TX+)	
4	Yellow	Z (TX-)	
5	Grey	B (RX-)	
6	Pink	A (RX+)	
7	Blue	Vin	
8	Red	Vin	

343 Power/RS422 Cable Assembly

The cable assembly to connect power and comms to the radar is **Part Number CA-310**. This cable is supplied in a 10m length and is shown below:

CA-310 has the same attributes as shown in the Connections table above.

POWER AND COMMUNICATIONS

Installation with Interface Enclosure

The radar can be powered and communicated with as per the specification, however for ease of installation, AGD provides a series of equipment to support simple integration into the road network and line protection for connected equipment.

The unit can be installed with or with out existing roadside network infrastructure, so the device can be installed in most situations.

AGD provide a 343 interface enclosure complete with power, communications and line protection to connect the detector.

Part No. MK343-03 - 343 Interface Enclosure (c/w 24Vdc PSU)

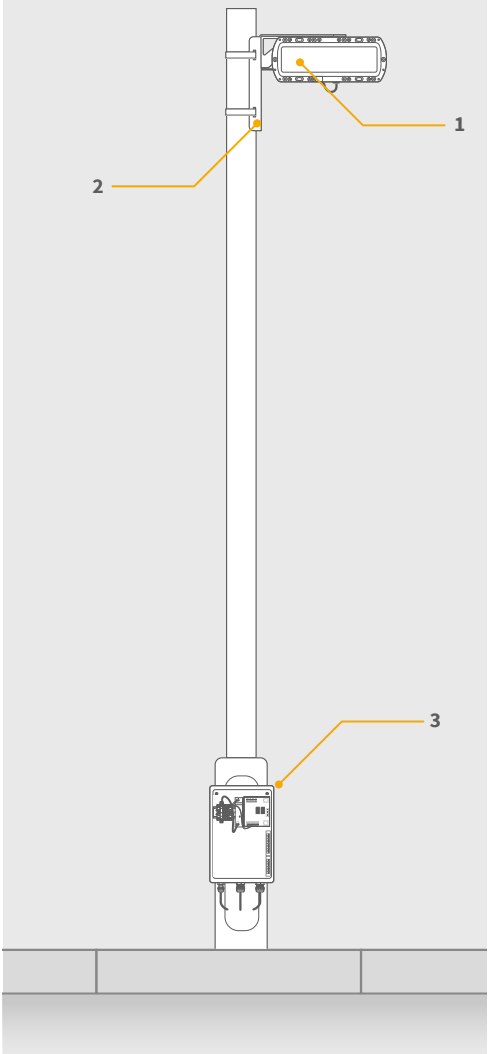
The detector, bracket and interface enclosure are secured to the pole using stainless steel banding as described previously.

Cable entry glands are provided for the customer to provide power to the device and connect the CA-310 Power/RS422 cable assembly.

Note The interface enclosure is delivered with blanking plugs fitted to the three cable glands.

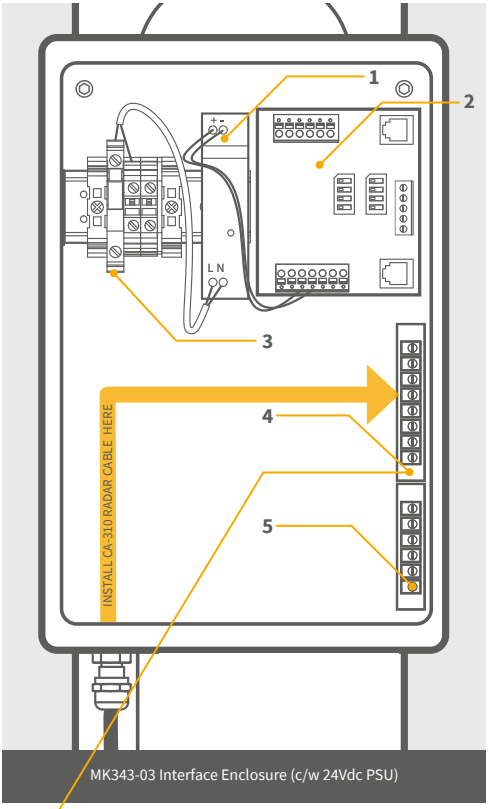
Items shown in diagram:

1. AGD 343 Highways Monitoring Radar
2. MS-246 Bracket Kit
3. MK343-03 Interface Enclosure (c/w 24Vdc PSU)



Typical installation with MK343-03 Interface Enclosure (c/w 24Vdc PSU)

POWER AND COMMUNICATIONS



MK343-03 Interface Enclosure (c/w 24Vdc PSU)

Interface Enclosure Components:

1. 110v-230Vac to 24Vdc PSU
2. RS422 Communications Interface Board
3. Incoming Power Connections
4. Radar Cable Connector
5. External Equipment Connector

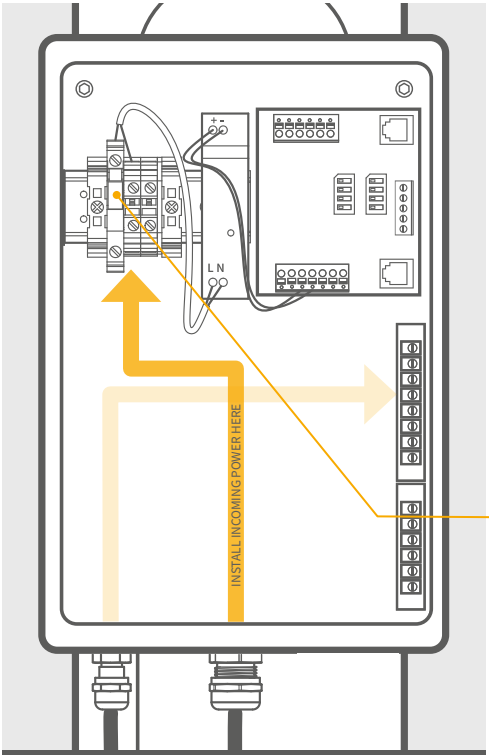
Connecting the Radar

The radar is connected to the 'TOP' of the two connectors situated on the right hand side of the interface enclosure. This is an 8 way screw connector and the connections are listed below, from top to bottom. The screw connector pulls out from it's receptacle to be wired.

The interface enclosure is pre-wired internally so only external connections are required.

CONNECTIONS		
Pin No.	**Associated wire colour**	**Function**
8	Pink	(RX+)
7	Grey	(RX-)
6	Yellow	(TX-)
5	Green	(TX+)
4	Blue	Vin
3	Red	Vin
2	Brown	Gnd
1	White	Gnd

POWER AND COMMUNICATIONS



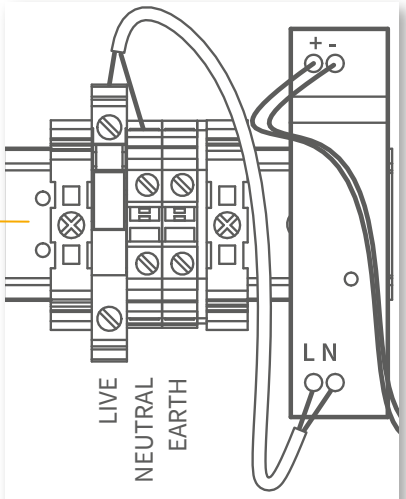
MK343-03 Interface Enclosure (c/w 24Vdc PSU)

Connecting the Power

The **MK343-03 Interface Enclosure** has DIN rail mounted connectors for connection to mains power. The 'Live' cable entry point incorporates a 0.5A thermal overload.

The cables are connected as shown below.

*Electrical installation should be carried out in accordance with local regulations.



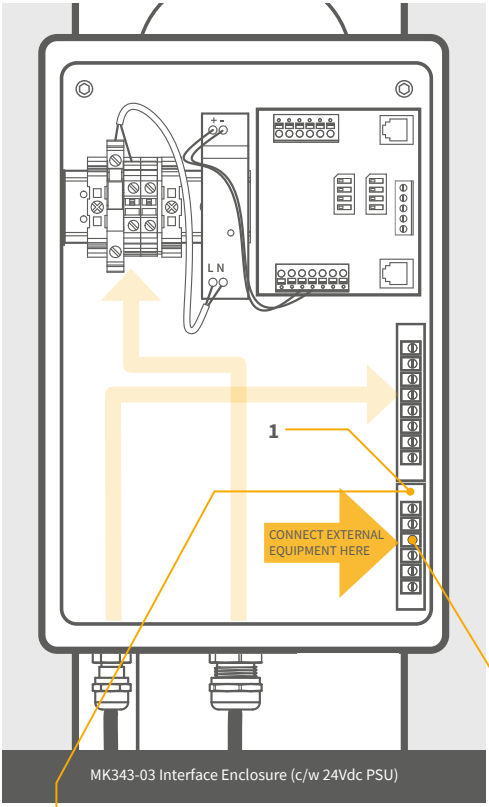
Incoming Power Connections and PSU

DC Power Supply

The power supply included as part of **MK343-03 Interface Enclosure** has spare capacity to allow for the user to connect some extra equipment. Information is detailed below:

Input Voltage Range:	85-264Vac
Output Range:	24Vdc, 1.25A, 30W
Spare capacity:	Startup current should be considered but spare capacity is around 15W, with one 343 radar connected.

POWER AND COMMUNICATIONS



Connecting External Equipment

External equipment can be connected to the external equipment connector **1.**

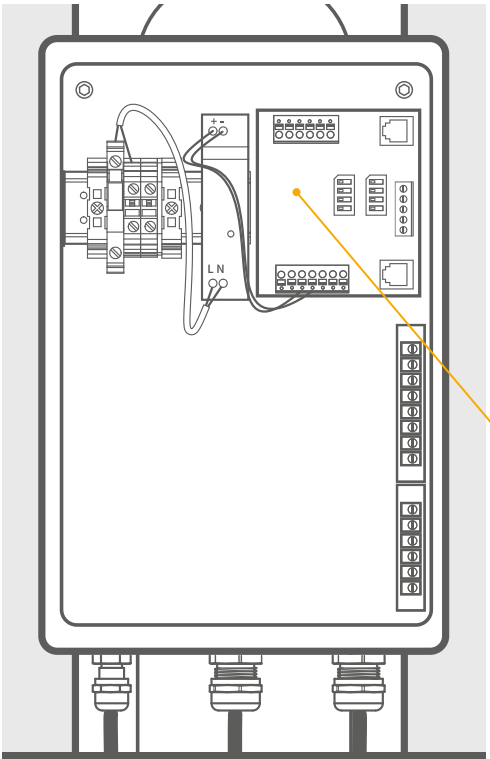
Whether this be an external ground cable as referenced in the next section '**Installation with Interface Enclosure & Rack Mounted Equipment',** or the connection of an integrators equipment to communicate with the radar.

Integrator equipment should be connected via the external equipment connector as per the pin outs below.

Important to note, when connecting external equipment, the RS422 functions will need to be reversed respectively

CONNECTIONS		
Pin No.	**Associated wire colour**	**Function**
6	Blue	(RX-)
5	Brown	(RX+)
4	Orange	(TX-)
3	Yellow	(TX+)
2	Red	Vin
1	Black	Gnd

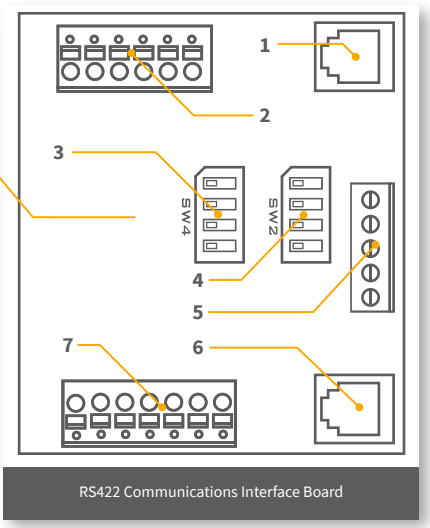
POWER AND COMMUNICATIONS



MK343-03 Interface Enclosure (c/w 24Vdc PSU)

RS422 Communications Interface Board

The RS422 communications interface board forms part of the **MK343-03 Interface Enclosure**. It handles the task of allowing multiple data connections to the radar, adjusting baud rates on different links for interfacing to equipment and provides important surge protection for connected devices.



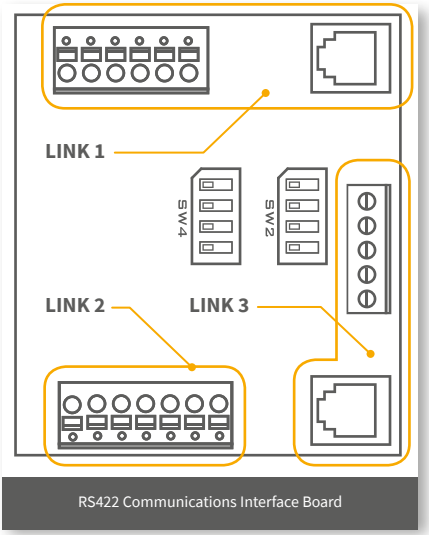
RS422 Communications Interface Board

RS422 Communications Interface Board - Overview

1. RJ11 socket sits on **'Link 1'**, directly connected to item 2.
2. Pre-wired connection to the radar cable connector. This connection sits on **'Link 1'** and is directly connected to item 1.
3. Dip switch SW4, controls the speed of the data on **'Link 1'.**
4. Dip switch SW2, controls the operating mode of the board and the speed of the data on **'Link 2'.**
5. Screw connector sits on **'Link 3',** directly connected to item 6.
6. RJ11 socket sits on **'Link 3',** directly connected to item 5.
7. Pre-wired connection to the external equipment connector. This connection sits on **'Link 3'.**

POWER AND COMMUNICATIONS

RS422 Communications Interface Board - Detailed Operation

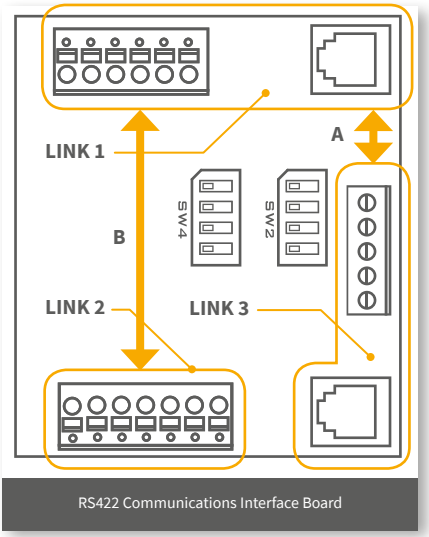


The RS422 Interface board connects the various ports as descibed below. Understanding this is very important when connecting to the radar to commission the device or when integrating other equipment.

LINK 1 - Pre-wired to radar cable connector, both ports joined.

LINK 2 - External link pre-wired to external equipment connector.

LINK 3 - Debug port connections, both ports joined.

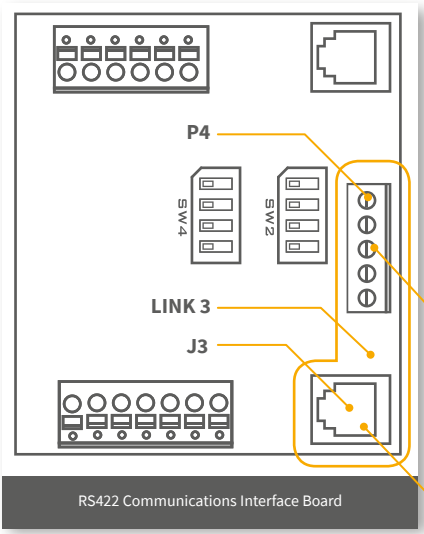


A. All data recieved on LINK 1 shall be passed out on LINK 3. All data recieved on LINK 3 shall be passed out on LINK 1.

B. All data recieved on LINK 2 shall be passed out on LINK 1. Data recieved on LINK 1 is filtered for certain types of message before being passed out on LINK 2.

POWER AND COMMUNICATIONS

RS422 Communications Interface Board - Debug Port Link



LINK 3 is the dedicated debug port link. This allows the radar to remain connected on 'LINK 1' to talk to external equipment on 'LINK 2' and a further connection be launched on 'LINK 3'.

LINK 3 - Hardwiring (P4 Connector)

To hardwire to LINK 3 via P4 connector, use the following pin outs:

LINK 3 CONNECTIONS	
Pin No.	Function
1	(RX+)
2	(RX-)
3	(TX+)
4	(TX-)
5	Gnd

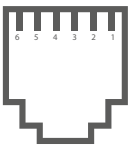
RS422 CONFIG PLUG IN HERE

LINK 3 - J3 (RJ11) Connector

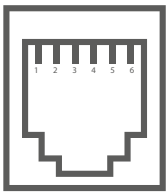
The pinouts shown correspond to the numbers highlighted on both the female and male plugs. Construction of a male connector is required should the end user want to use a RS422-USB converter of their own choice.

A configuration cable can be obtained pre-assembled from AGD Systems:

Part No. CA-345 USB-422 343 Configuration Cable



RJ11 Male Pin-outs



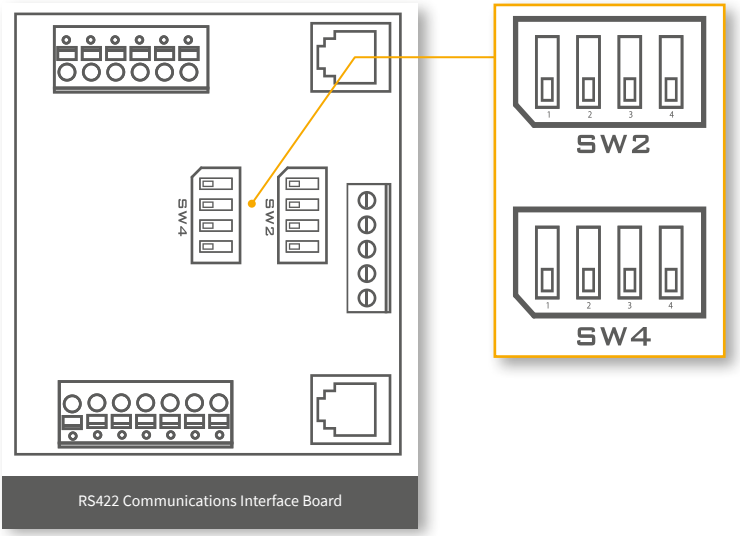
RJ11 Female Pin-outs

LINK 3 - J3 (RJ11) CONNECTIONS	
Pin No.	Function
1	(RX+)
2	(TX+)
3	(TX-)
4	(RX-)
5	Gnd
6	Gnd

***IMPORTANT NOTE -** These functions are correct at the relevant connectors.

POWER AND COMMUNICATIONS

RS422 Communications Interface Board - Dip Switches



RS422 Communications Interface Board

RS422 Communications Interface Board - Setting Dip Switches

The dip switches SW2 and SW4 control the operating mode of the board and the data rates of the equipment connected on different links. *SW2-1 should always be set to 'OFF' inside the MK343-03 interface enclosure.

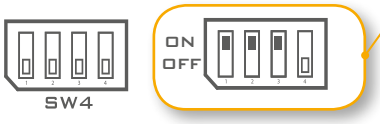
***SW2** can be set as per the table on the right. Recommended values are highlighted in orange and shown in actual postitions below.

SW2 - DIP SWITCH SETTINGS	
SW 2-1	Operating Mode
Off	Mode 1
On	Mode 2

SW2 - DIP SWITCH SETTINGS		
SW 2-2	SW 2-3	Link 2 Speed
Off	Off	9600
On	Off	19200
Off	On	38400
On	On	115200

POWER AND COMMUNICATIONS

RS422 Communications Interface Board - Setting Dip Switches

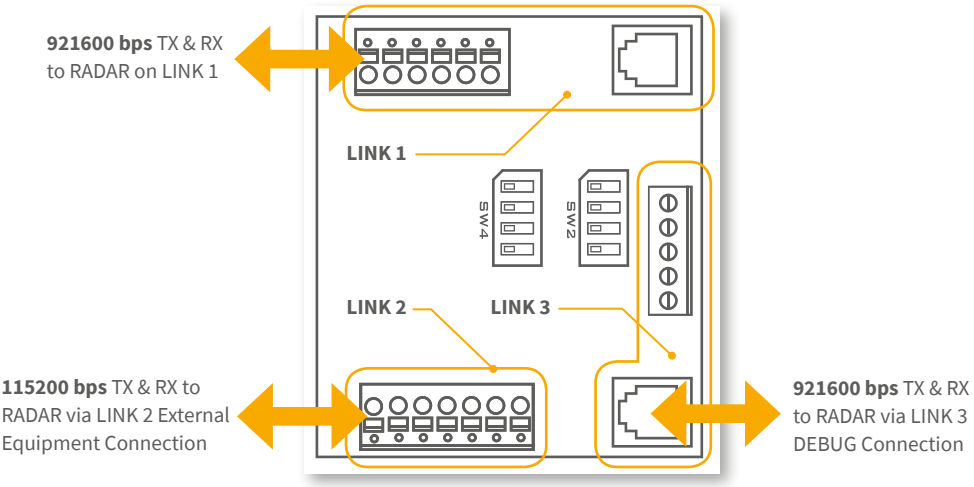


SW4 controls the BAUD rate of LINK 1 and LINK3. The LINKS operate at the same data rate. **SW4** can be set as per the table below. Recommended values are highlighted in orange and shown in actual postitions to the left.

SW4 - DIP SWITCH SETTINGS

SW 4-1	SW 4-2	SW 4-3	Link 1 & 3 Speed
Off	Off	Off	9600
On	Off	Off	19200
Off	On	Off	38400
On	On	Off	57600
Off	Off	On	115200
On	Off	On	230400
Off	On	On	460800
On	On	On	921600

RS422 Communications Interface Board - Data Rate Overview and Connections



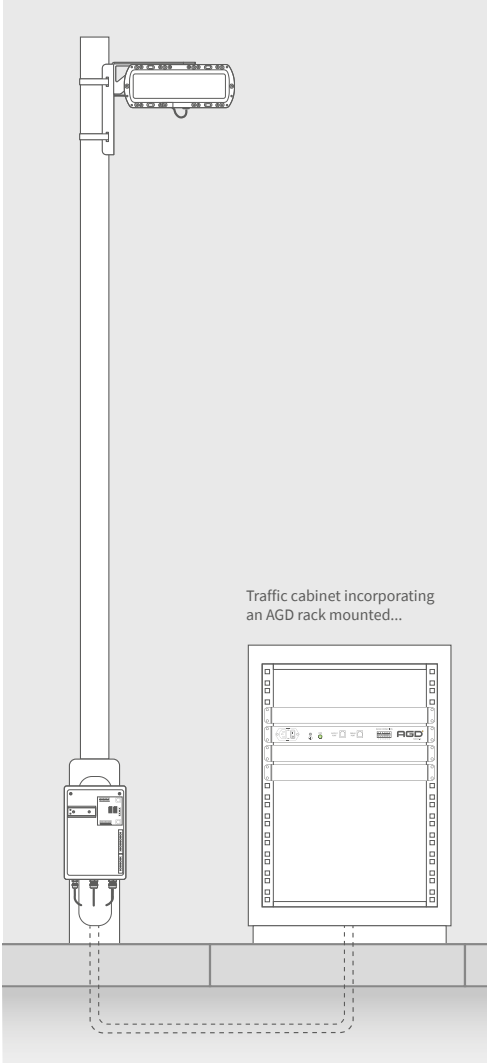
POWER AND COMMUNICATIONS

Installation with Interface Enclosure & Rack Mounted Equipment

If installing the equipment combined with existing infrastructure (existing traffic cabinet for example). The AGD 343 interface enclosure with communications and line protection would be used. Part No. MK343-01 - 343 Interface Enclosure.

*Please note that this variant, does not have a power supply and is intended for use with an MK343-02 – 343 19” Interface Rack.

This is a placeholder section in the manual and further information will be populated as required

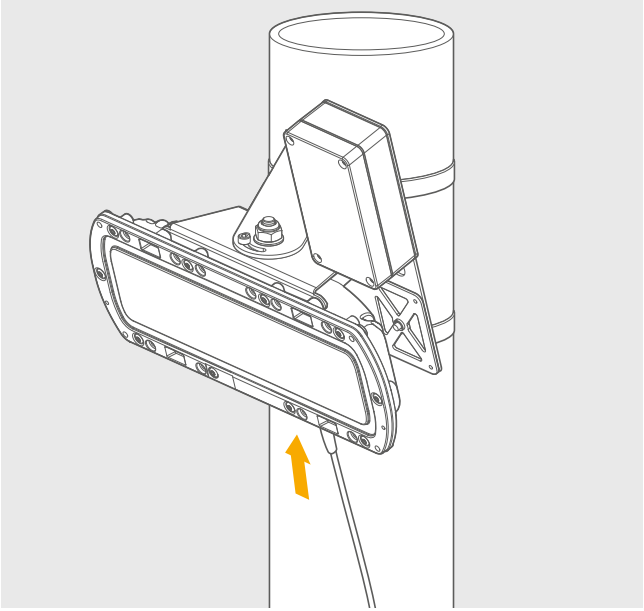


Power connection to existing traffic cabinet

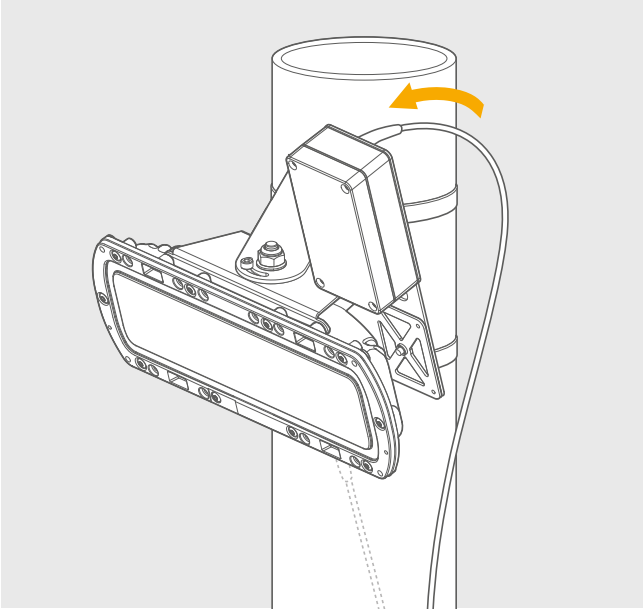
CAMERA CONNECTION

The AGD 343 Highways monitoring radar uses a small detachable camera to assist with aligning the radar to the roadway. The whole commisioning process can be done using the wireless connection hosted by the camera but it should be removed at the end and then instructions followed on how to attach to the radar using a wired RS422 connection.

Step 1 – Mount set-up camera to the radar bracket using the four alignment pins, secure the single thumb screw.



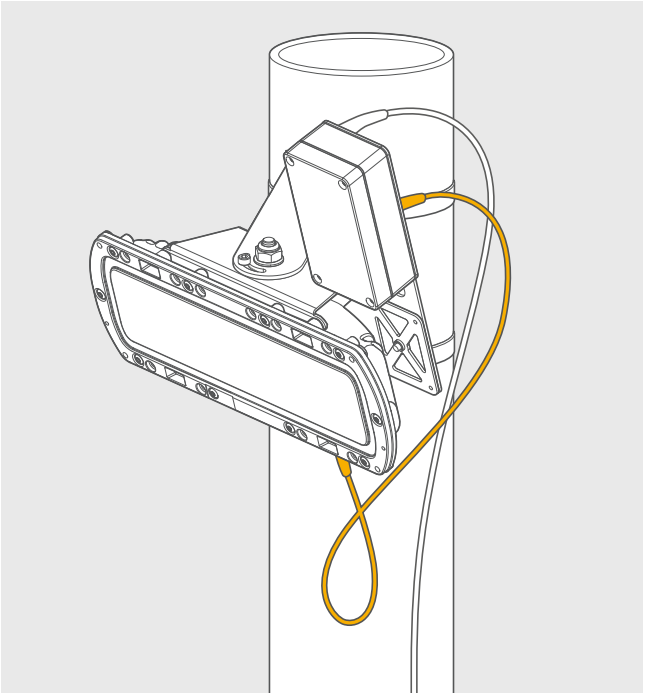
Step 2 – Re-position the radar cable into the the top camera cable port as shown right.



CAMERA CONNECTION

Step 3 - Fit the yellow interrupter cable between the bottom camera port and the radar (the cable is keyed so can only be connected one way)

Once connected and powered the camera will cast a WiFi network that will allow initial alignment to be configured.



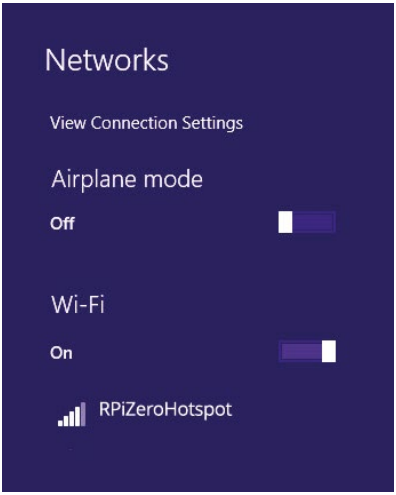
WIFI CONNECTION

In network WiFi connections search for:

RPiZeroHotspot

Select the network, click 'connect' and input the default password:

AboveGroundSensorsPiZero



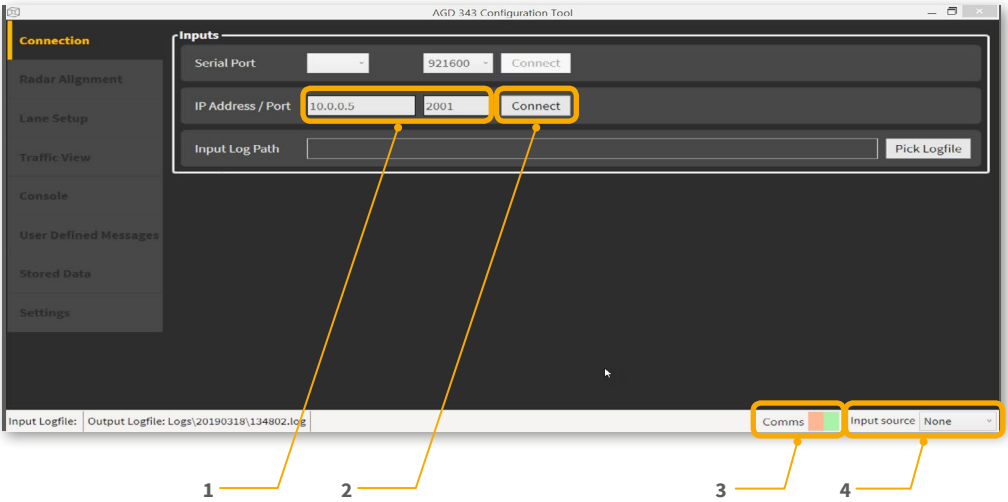
AGD ALIGN SET-UP TOOL

AGD Align Set-up Tool

The AGD Align set-up tool is a graphic user interface, GUI, that allows the commisioning engineer to correctly align and configure the radar once installed. The software can be downloaded by contacting AGD Systems via email at:

customer.support@agd-systems.com

Connection (WiFi)



After installation, an icon will be placed on the desktop. When launching the GUI, the above window is presented. All options on the left hand side except the '**Connection**' are greyed out.

For initial setup, it is required to connect via the '**TCP**' option to the setup camera.
Follow the numbered steps above.

IP address and port should be as follows:

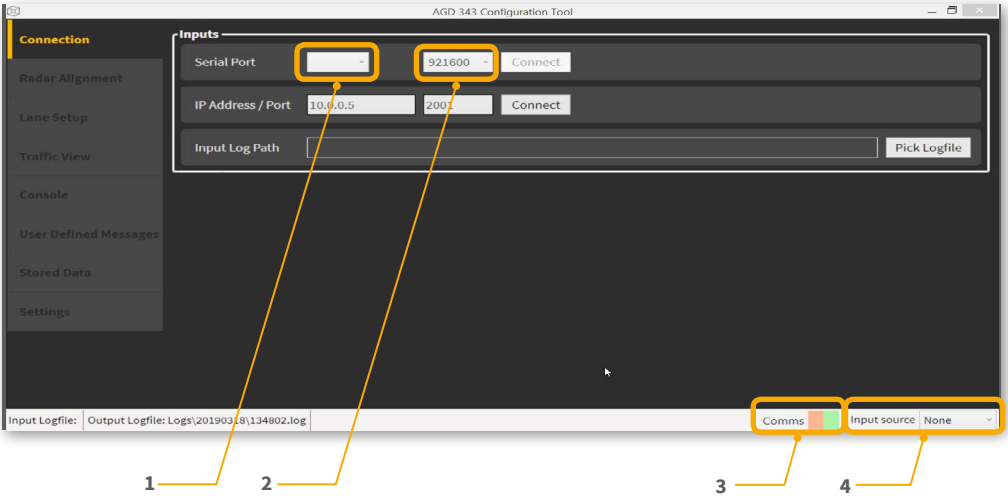
1. IP Address: **10.0.0.5** Port: **2001**
2. Click **'Connect'**
3. The **'Comms'** LED bars across the bottom should illuminate red and green to signal communication
4. The **'Input Source'** field should now show a **'TCP'** connection.

The menu bar on the left hand side should now be illuminated and able to be selected.

AGD ALIGN SET-UP TOOL

Connection (RS422)

Skip this step if a WiFi connection has been made and the camera is being used for alignment



When launching the GUI, the above window is presented. All options on the left hand side except the '**Connection**' are greyed out.

Identify the serial port the USB-422 Configuration Cable is attached to:

1. COM Port: **COM 01** (This is an example COM port) Baud Rate: **921600**
2. Click **'Connect'**
3. The **'Comms'** LED bars across the bottom should illuminate red and green to signal communication
4. The **'Input Source'** field should now show a **'serial'** connection.

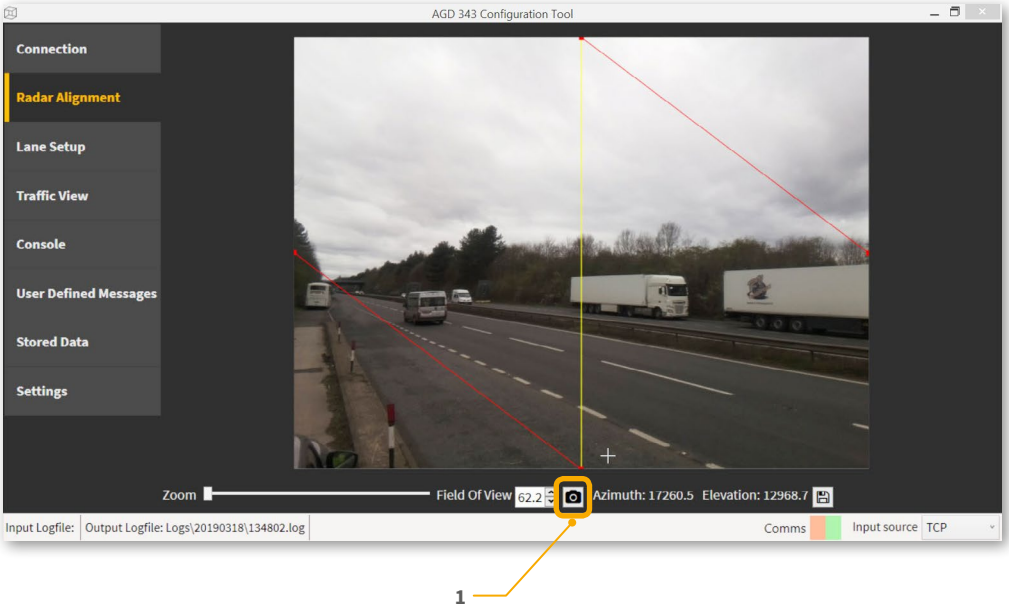
The menu bar on the left hand side should now be illuminated and able to be selected.

AGD ALIGN SET-UP TOOL

Radar Alignment

The radar must have its 'Azimuth' angle aligned to 30 degrees(with a +- 1 degree tolerance). Follow the four steps in the alignment process to achieve this.

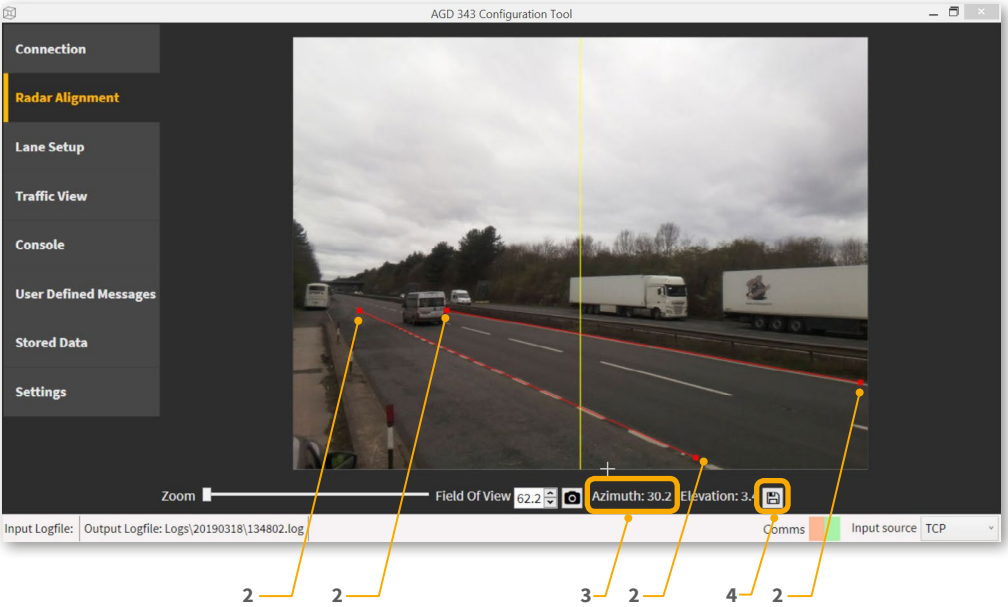
***NOTE** - The image below shows a reference of what the radar sees when correctly aligned. Note the yellow line in the middle. This is the 'bore sight' of the radar and gives an indication of where the radar is looking. It is important that if there is street lighting in the area and it is centred in the road, that traffic is not obscured by the street lighting column or any other furniture.



1. 'Click' the camera icon. This will download a still picture to the screen.

AGD ALIGN SET-UP TOOL

Radar Alignment



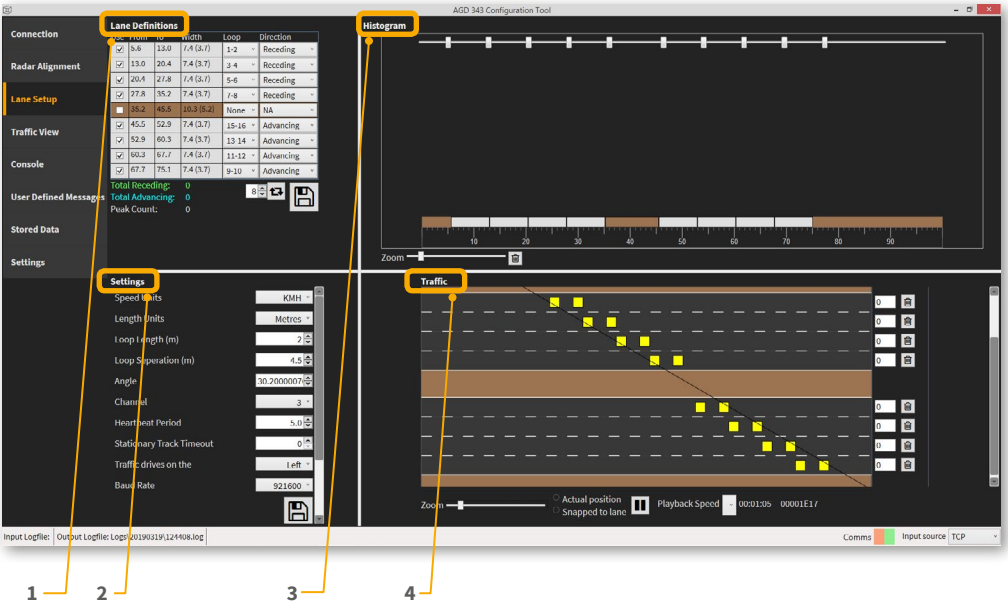
2. Drag the red boxes, align the red lines to the white lines on the highway surface.
3. Read back the angle, adjust the radar alignment and repeat the process until the 30 degree azimuth angle has been achieved.
4. 'Click' the save icon. This will write the azimuth and elevation angle settings to the radar.

***Make sure to tighten the radar mounts and lock the radar position at this point.**

The camera can now be removed and the RS422 interface cable connected directly to the radar.

AGD ALIGN SET-UP TOOL

Lane Setup Window

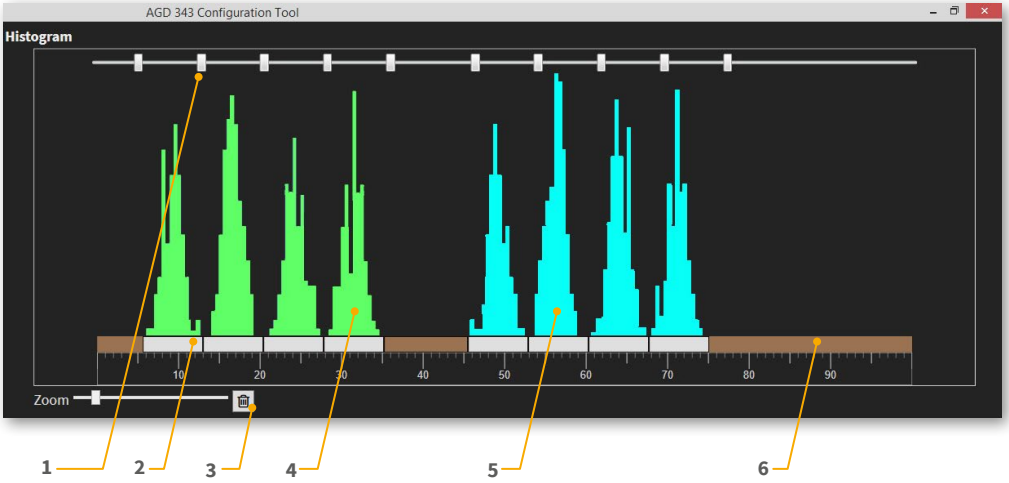


The four panes that are shown in the **'Lane Setup Window'**:

1. **Lane Definitions** - Lanes are defined by range in this window. Virtual loop assignments can be made (when used with an AGD Loop interface card) and the traffic direction of each lane is assigned.
2. **Settings** - Main page for all adjustable settings for the radar.
3. **Histogram -** Histogram populates as traffic passes the detector, lane assignment ranges are adjusted in this window.
4. **Traffic** - Live representation of traffic passing the detector.

AGD ALIGN SET-UP TOOL

Lane Setup - Traffic Histogram



The traffic histogram window shows the distribution of vehicles as they pass the radar detector. Vehicles are assigned by range so that the Lanes can be defined.

Green data shows receding targets and blue data shows advancing targets in this image.

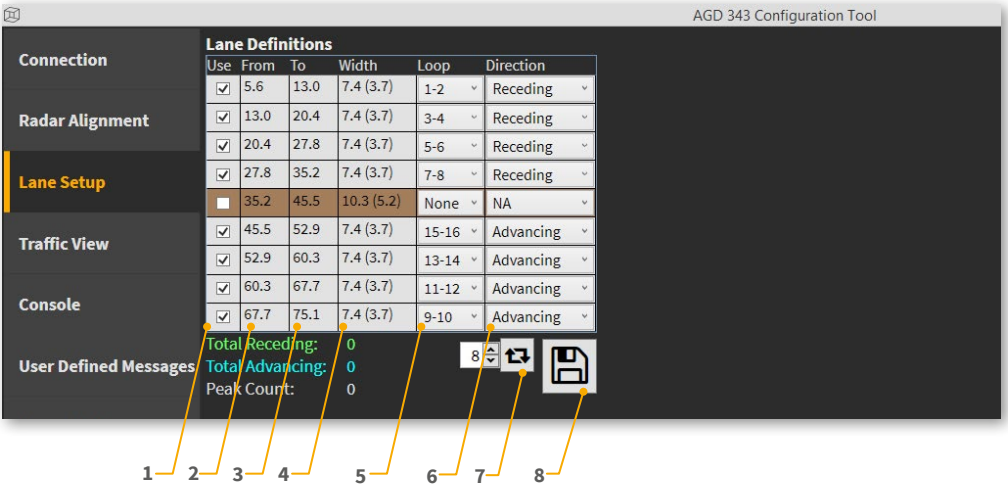
1. **Lane Sliders** - Lanes are defined by range with these sliders, moving them left to right will change the range being shown in the lane definitions window and the size of the 'lane area'
   Hitting 'Delete' will remove a 'lane slider'. 'Double clicking' will add a 'lane slider'.
2. **Lane Area** - This area is coloured grey and denotes an active zone of detection. As the 'lane slider' is adjusted, this area grows or shrinks to represent the range being assigned.
3. **Bin -** 'Clicking' the bin will remove all current traffic histrogram history out of the histogram window and the radar will start to populate new traffic data as targets pass the detector.

4/5. **Traffic Data** - Representation of traffic passing the detector based on its range from the radar.

6. **Ignored area -** The brown area is ignored and represents areas where we are not interested in registering a detection.

AGD ALIGN SET-UP TOOL

Lane Setup - Lane Definitions

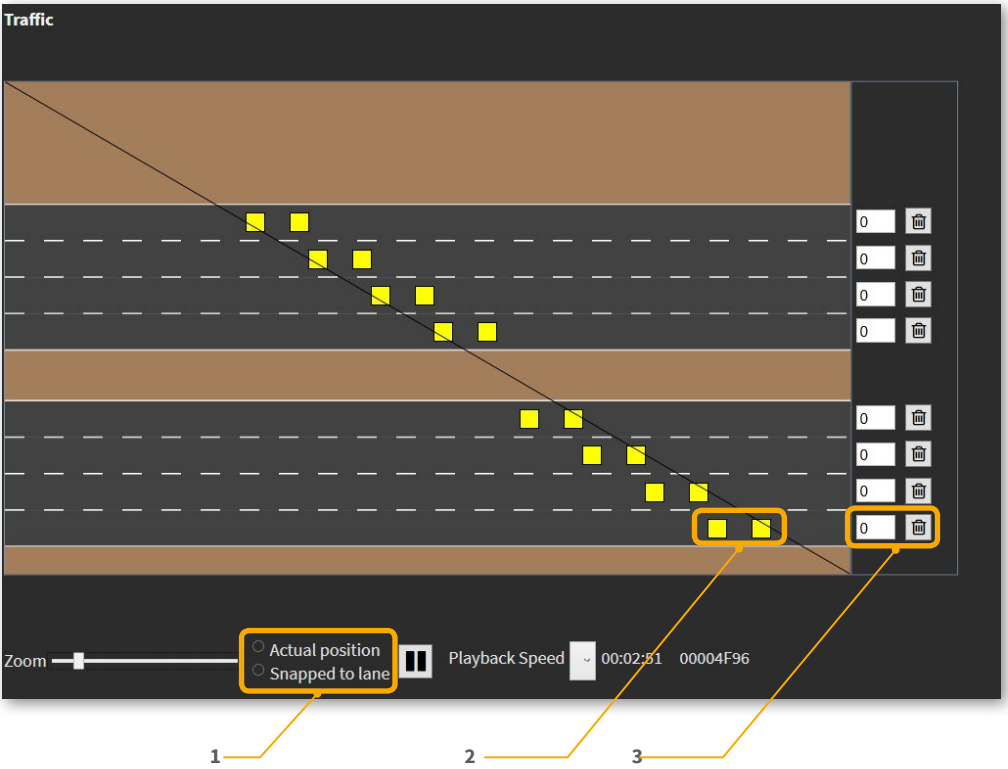


Lane definitions window shows table of values attiributed to each lane.

1. **'Use' Tick Box** - Deselecting this will stop detections being made in this lane.
2. **'From' Range Value** - This value represents the lower figure as in the distance from the radar until the start of what we define as a lane.
3. **'To' Range Value -** This value represents the upper figure as in the distance from the radar until the end of what we define as a lane.
4. **'Width' Value** - Width of the defined lane, basically the distance between the value in the 'from' and 'to' range value boxes. This value is the width of the lane at 30 degrees. The value in the bracket is the perpendicular width of the lane.
6. **'Loop' Number -** This is the 'virtual loop' pair number you assign to a lane. ***NOTE** -If you are not using an AGD interface Card. Set this to 'None'
7. **Quick Lane Add -** Increment the valuie to the number of lanes you require then 'click' the 'refresh' button. This will automatically add the set amount of lanes into the histogram window.
8. **Save Button -** Writes the definitions to the radar.

AGD ALIGN SET-UP TOOL

Lane Setup - Traffic View

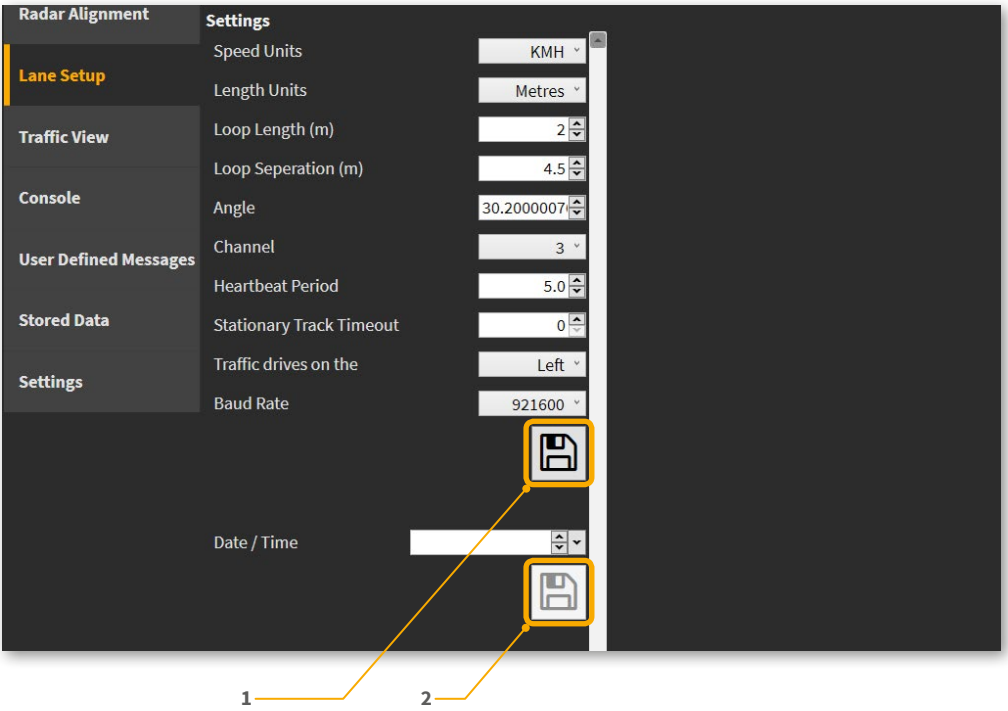


The traffic view window shows live traffic flowing in the configured lanes.

1. **Actual Position / Snapped to lane** - If 'actual position' is selected, the target will be shown in the lane in the actual position it is detected. If 'snapped to lane' is selected, the target will appear in the middle of the lane it has been assigned.
2. **Virtual Loops** - If defined in 'lane definitions' the loops will be shown in the roadway and will flash red when a target passes over them.
3. **Target Count -** This count increments as each target passes the radar and is detected. The 'bin' icon is used to reset the count. This feature has been added to assist with verification of the radar data when commisioning.

AGD ALIGN SET-UP TOOL

Lane Setup - Settings



The 'settings' window contains a series of adjustable parameters, listed top to bottom here:

Speed Units (vehicle) - Selectable between either 'kilometres per hour' (KMH), or 'miles per hour' (MPH).

Length Units (vehicle)- Selectable between either 'Metres' or 'Feet'.

Loop Length (m) - The size of the virtual loop that the radar creates in distance from front to back.

Loop Seperation (m) - The distance from the start of the first virtual loop to the start of the second virtual loop.

Angle - Azimuth mounting angle of the radar. This value is set on initial alignment using the camera set-up tool. DO NOT ADJUST THIS ANGLE ONCE SET.

Channel - Channel transmit frequency, more detail on this is contained in the 'radar characteristics' section of the manual.

Lane Setup - Settings (continued)

Heartbeat Period - Time in seconds between heartbeat messages being sent by the radar.

Stationary Track Timeout - Time in seconds that the radar holds a target track once a target is stationary.

Traffic drives on the - Select left or right depending on the country of installation.

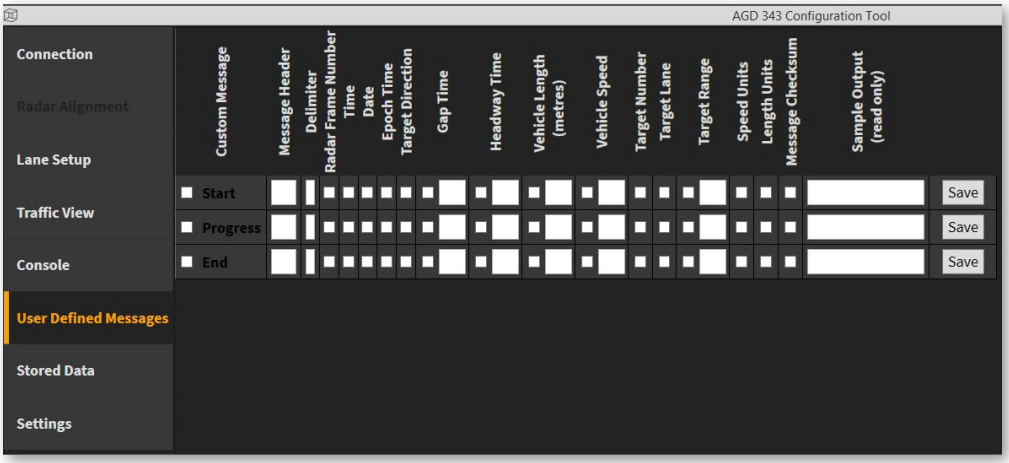
Baud rate - Baud rate of the radar. It is suggested this is left at 921600. If this is adjusted, the interface equipment the radar feeds into will also need adjusting.

Date/Time - Set the value of the real time clock in the radars memory.

1. **Save** - 'Clicking' the 'Save' icon will write settings to the radar. Unless this is clicked, the settings will not be saved permanently.
2. **Save Date/Time** - Writes the value set in the 'Date/Time' field to the radars memory.

AGD ALIGN SET-UP TOOL

User Defined Messages



The radar constantly publishes ‘Event Messages’ for each target that passes through the beam. These messages are used and displayed by the GUI. They do not have every item of information the radar is able to provide in them.

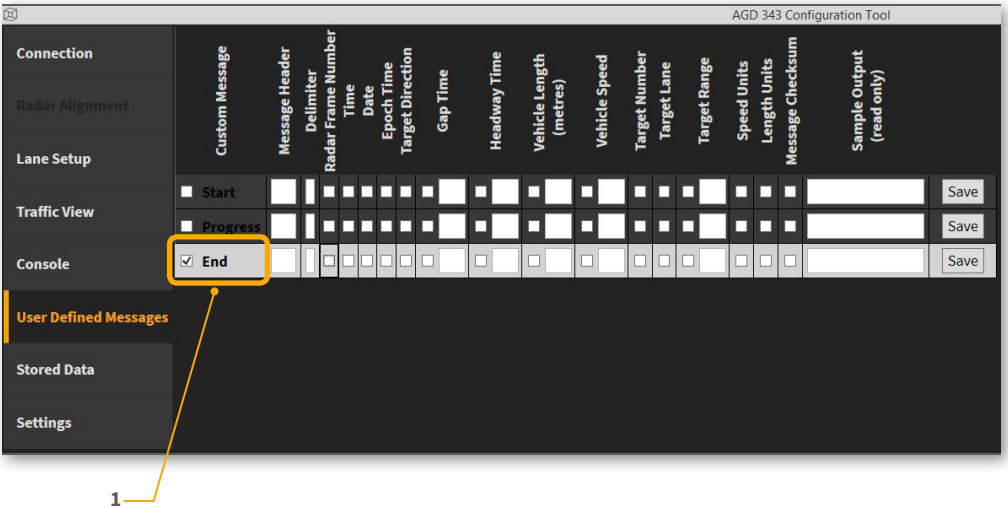
For traffic data applications or integration, the end user will want to select a ‘User Defined Message’ for the radar to output.

Unless integrating into a system where instant data is required the very moment the target enters the radars beam, It is suggested that the ‘EE’ event message is used. ‘EE’ represents ‘Event End’. This message will be a summary of all the data for each target that passes by the radar.

The variety of data that is contained in the string and how it looks is totally configurable by the user and is explained in further detail in the ‘User Event Messages’ section of the manual.

AGD ALIGN SET-UP TOOL

User Defined Messages - Building an Output Message



Selecting the tickbox next to any of the three 'User Defined Messages' will activate them. In the diagram above, the callout **no. 1** shows the 'EE' or 'Event End' message has been activated.

Details of content that be combined into a message is explained below:

Message Header - Custom field you can enter text here.

Delimiter - Installs a ',' (comma) after the 'Message Header'.

Radar Frame Number - The frame number associated with the detection.

Time - HH.MM:SS.SSS

Date - DD/MM/YY

Epoch Time - 64bit Hexadecimal value in milliseconds since 1st Jan 1970 (universal time).

Target Direction - 'A' = advancing traffic, 'R' = receding traffic.

Gap Time - Time in secs between the back of the previous target detected and the front of current target. Free text field attached to this value.

Headway Time - Time in secs between the front of the previous target detected and the front of current target. Free text field attached to this value.

Vehicle Length - Length measurement of the detected target in metres. Free text field attached to this value.

User Defined Messages - Building an Output Message (continued)

Vehicle Speed - Value of the output speed, please note KPH/MPH is selected in the 'Settings' of the GUI.

Target Number - Number assigned by the radar to a specific target.

Target Lane- Lane number that the reported target has been assigned.

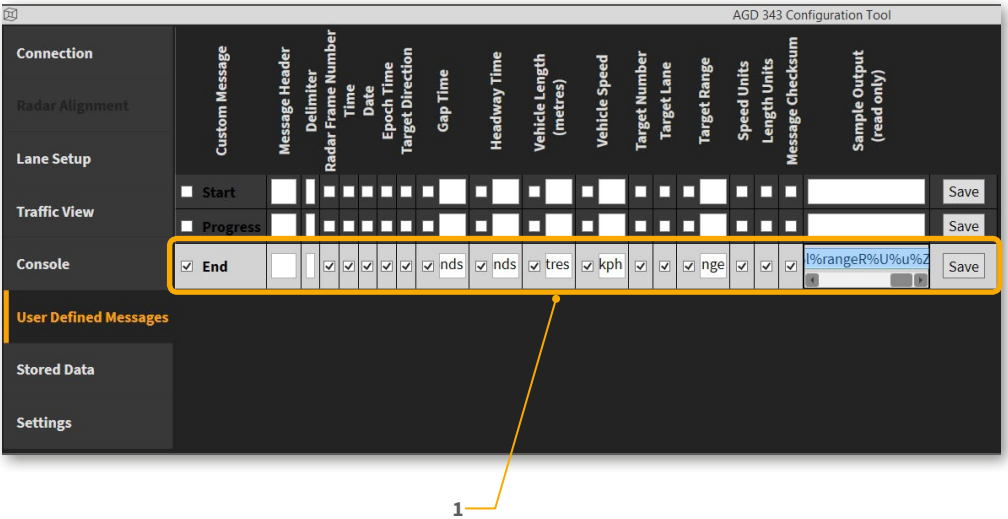
Target Range - Distance to the target in units designated by the 'length units' command. (This is the distance from the radar at 30 degrees).

Speed Units - 'M' = MPH, 'K' = KPH.

Length Units - 'M' = Metres, 'F' = Feet. (This value affects the units of the 'Target Range')

Message Checksum - Message checksum CRC8. Inserts a 2 digit hexadecimal number that is the CRC8 value of the proceeding characters.

User Defined Messages - Output Message Example



If it were decided to select all the fields to combine into an 'EE' output message, along with some free text entries, the following would be representative of the output:

%N%t%d%e%D%secondsG%secondsH%metresL%kphS%T%l%rangeR%U%u%Z

Substitute in some values:

4565DF, 04/02/19, 15:12:30.861, 00000168B911628DR, R, 1.020969seconds, 1.442857seconds, 4.195518, 35.45695Kph, 02, 1, 12.48059range,K,M, 4.195518

The text fields do not have to be used, they were used here as an example. The string above would create a real output as above.

RADAR COMMAND OVERVIEW

Commands are used to control the operation of the radar. These are sent over the RS422 UART link.

Commands are immediately followed by an operator that indicates the required action. Not all operators are supported for all commands. Where an operator is used and it is not supported the radar will respond with a warning message. The table shows the operators that are used by the radar.

Operator	Operation
=	Set something to a value e.g. *DIR=A<CR> sets detect direction to approaching
?	Respond with value or values
^	Set default value for parameter
$	Provide help on the command e.g. *DIR$<CR>
!	Do something e.g. *REBOOT! Reboots the radar

Command Operators

Where a command is used to enquire or set a radar parameter the radar will respond in a set way. The radar will respond with a hash, #, followed by the command name, operator used and then the value of parameter or parameters.

For example

***DIR=A<CR>** **Radar responds with #DIR=A<CR>**

***DIR?<CR>** **Radar responds with #DIR?A<CR>**

Radar Commands

AGD **343**
HIGHWAYS MONITORING RADAR

RADAR COMMAND LIST

Command	Type	Function	Default Value	Min Value	Max Value	Units, Resolution or Values
AGD		Provides the firmware version				
*BAUD	? / = / == / $	Used to set/enquire RS422 baudrate	921600	19200	921600	*BAUD=921600<CR> Valid baud rates: 19200, 38400, 57600, 115200, 230400, 460800, 921600
*CD	? / = /== / $	Used to set/enquire radars calibration date				*CD=DD/MM/YY<CR>
*DATE	? / =/ = = / $	Used to set/enquire radar date and time				*DATE=DD/MM/YY HH:MM:SS<CR>
*DM	? / =/ = = /$	Used to turn debug messages on and off				*DM=0<CR> turns debug off *DM=1<CR> turns debug on
*DSD	=/ = = /$	Delete data store files				*DSD=RD111018.LOG<CR>
*DSL	? / $	Lists the data store files				*DSL?<CR>
*DSRF	? / =/ = = / $	Set/Query data store report format				Max string length 127 characters
*EM	? / =/ = = / $	Used to turn event messages on and off				*EM=0<CR> turns EM off *EM=1<CR> turns EM on
*FEM	? / =/ = = / $	Set/Query filtering of event messages				*FEM=1<CR> Turn filtering on
*FFD	! / $	Sets the radar to factory default values				*FFD!<CR>
*FPB	! / $	Instruct radar to burn loaded program to flash				*FPB=<SHA256><CR>
*FPD	= / $	Command for transferring new program data				
*FPI	! / $	Command to initialise radar for a new program load				*FPI!<CR>
*FRB	! / $	Copy secondary flash image into primary image location				*FRB!<CR>
*HASH	? / $	Determines SHA256 hash of radars program				*HASH?<CR>
*HBP	? / =/ = = / $	Set/Query heart beat period in seconds	5	0	3600	*HBP?<CR> *HBP=5<CR> heartbeat period 5 secs *HBP=0<CR> turns off heartbeat
*ID	? / $	Enquire radar ID number				*ID?<CR>
*LANE	? / =/ = = / $	Used to enquire/set lane setup				*LANE=<Number>,<Direction>,<Min Range>,<Max Range><CR> <Number> 0-15 <Direction> +/R = receding -/A = advancing <Min Range> = 0 to max range <Max Range> = min range to 100
*LANE-DEL	$	Used to delete lane definitions				*LANE-DEL=1<CR> Delete lane 1 definition *LANE-DEL=*<CR> Delete all lane definitions

RADAR COMMAND LIST (CONTINUED)

Command	Type	Function	Default Value	Min Value	Max Value	Units, Resolution or Values
*LIFE	? / $	Reports life statistics				*LIFE?<CR>
*LM	? / =/ = = / $	Used to turn loop messages on and off				*LM=0<CR> Turn loop messages off *LM=1<CR> Turn loop messages on
*LOOP	? / =/ = = /$	Used to query and add loop data				*LOOP=<Loop Pair Number>,<Lane Number>,<Loop Separation>,<Loop Length><CR> <Loop Pair Number> max value 15 <Lane Number> 0-15 <Loop Seperation> 0-10 <Loop Length> 0-10 *LOOP?<CR>
*LOOP-DEL	=/ = = / $	Used to delete a loop definition				*DEL-LOOP=1<CR> Delete loop 1 definition *DEL-LOOP=*<CR> Delete all loop definitions
*LU	? / =/ = =	Set/Enquire length units				*LU=F<CR> Set length units to feet *LU=M<CR> Set length units to metres
*MA	? / =/ = =	Set/Enquire radar mounting angles				*MA?<CR> *MA=<Azimuth Angle>,<Road Incline><CR>
*PUS	! / $	Programs current radar settings as user settings				*PUS!<CR>
*RDR	? / =/ = =	Retrieve data records from log for period specified				*RDR=<Begin record time>,<End record time><CR>
*REBOOT	! / $	Performs a software activated reset				*REBOOT!<CR>
*STT	? / =/ = = / $	Set/Enquire stationary track timeout (seconds)				*STT?<CR> *STT=60<CR> Set timeout to 60 seconds
*SU	? / =/ = = / $	Set/Enquire speed units				*SU?<CR> *SU=M<CR> Set speed units to MPH *SU=K<CR> Set speed units to KPH
*TEMP	? / $	Enquire processor and microwave module temperatures in degrees Celsius				*TEMP?<CR>
*TXCH	? / =/ = =	Set/Enquire transmit channel				*TXCH=1<CR> Set transmit channel 1 *TXCH?<CR> Query present transmit channel *TXCH=*<CR> Query possible transmit channels
*UEEMF	? / =/ = =	Enquire/set user event end format string				*UEEMF?<CR> *UEEMF=User Event End Message<CR> Max string length 127 characters

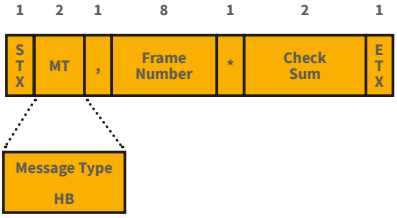
RADAR COMMAND LIST (CONTINUED)

Command	Type	Function	Default Value	Min Value	Max Value	Units, Resolution or Values
*UEM	? / =/ = =	Enquire/set user event messages				*UEM?<CR> *UEM=1<CR> Enable user event start message *UEM=2<CR> Enable user event progress message *UEM=4<CR> Enable user event end message *UEM=7<CR> Enable all user event messages
*UEPMF	? / =/ = =	Enquire/set user event progress format string				*UEPMF?<CR> *UEPMF=User Event End Message<CR> Max string length 127 characters
*UESMF	? / =/ = = / $	Enquire/set user event start format string				*UESMF?<CR> *UESMF=User Event End Message<CR> Max string length 127 characters
*VER	? / $	Used to enquire the version of software				*VER?<CR>
*VOLTAGES	? / $	Used to enquire the power supply voltages				*VOLTAGES?<CR>
*LIST	! / $	Lists the commands				LIST!<CR>
*STATUS	! / $	Lists settings				STATUS!<CR>

RADAR EVENT MESSAGES

HEART BEAT MESSAGE

The heart beat message is sent periodically. The period of the message is controlled by the *HBP command.



Heart Beat Message Format

Name	Size / Bytes	Value	Notes
STX	1	2	Start of message byte
MT	2	‘HB’ = Heart Beat	Message type
,	1	‘,’	Comma
Frame Number	8	XXXXXXXX	Frame number in hexadecimal format
*	1	‘*’	Asterisk
Checksum	2	‘XX’	Checksum in hexadecimal format (reference checksum calculation)
ETX	1	3	End of message byte

Heart Beat Message Output Example

HB,013B0663*3F

Message Formats

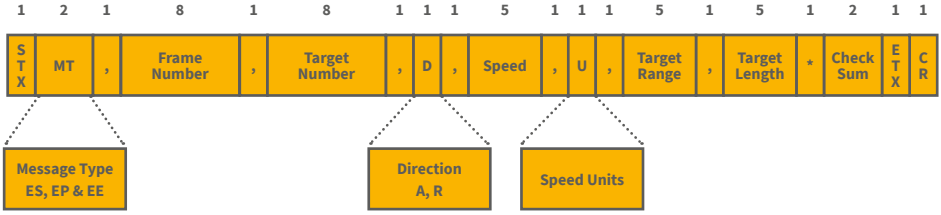
AGD **343**
HIGHWAYS MONITORING RADAR

RADAR EVENT MESSAGES

Event messages are sent when enabled by setting *EM=1. Messages can be filtered so that only messages associated with defined lanes are reported. This filtering is enabled by sending the command *FEM=1.

Three types of event messages are produced by the radar, these are:-

- **Event Start, ES** This message is sent when the radar has decided a target is present.
- **Event Progress, EP** This message is sent for every 2 metres of distance travelled by the target or when the target becomes stationary.
- **Event End, EE** This message is sent when the target has travelled a distance that is equivalent to its length since the target's ES message was sent.



Name	Size / Bytes	Value	Notes
STX	1	2	Start of message byte
MT	2	02	Message type: ES = Event Start, EP = Event Progress, EE = Event End
,	1	','	Comma
Frame Number	8	XXXXXXXX	Frame number in hexadecimal format
,	1	','	Comma
Target Number	2	XX	Target number
,	1	','	Comma
Direction	1	'A' = Approaching Target 'R' = Receding Target	Direction the target is travelling.
,	1	','	Comma
Speed	5	'DDD.D'	Target speed to one decimal place in decimal format
,	1	','	
Speed Units	1	'M'=MPH 'K'=KPH	The speed units used for the measurement
,	1	','	Comma
Target Range	5	'DDD.D'	Target range in metres
,	1	','	Comma
Target Length	5	'DDD.D'	Target length in metres
*	1	'*'	Asterisk
Checksum	2	'XX'	Checksum in hexadecimal format (reference checksum calculation)
ETX	1	3	End of message byte

RADAR EVENT MESSAGES

Radar Event Message Output Example

Event Start - ES,0139DA31,00000DD9,A,084.5,M,022.6,021.5*C0

Event Progress - EP,0139E0CA,00000DDA,A,083.9,M,022.3,337.5*5D

Event End - EE,0139E0CE,00000DDA,A,083.6,M,022.3,337.5*40

USER EVENT MESSAGES

User Event Messages

User event messages are enabled with the *UEM command. The table below shows which messages are enabled by enabling the various bit positions.

Bit No	Message enabled
0	Event start
1	Event progress
2	Event end

As an example using *UEM=5 will enable the user event start and event end messages.

User event message format is defined by the user using the following commands:-

***UESMF=<Format string>**
This is used to define the user event start message format

***UEPMF=<Format string>**
This is used to define the user event progress message format

***UEEMF=<Format string>**
This is used to define the user event end message format

The format string can be used to control the output format of the user event messages. The format string consists of the ASCII text that the user wishes to insert along with format specifiers, listed in the above table. An example of a format string is:-

Time=%t Speed=%5.1S%U Direction=%D%13X

Placing %13X is a way to put a carriage return on the end of the messages (13 is the decimal value of the ASCII character 'CR')

USER EVENT MESSAGES

User Event Messages continued

%N	Radar frame number
%t	Time downto milliseconds HH:MM:SS.SSS
%d	Date (dd/mm/yy)
%e	Epoch time 64bit hexadecimal milliseconds since 1st Jan 1970
%D	Target direction of travel (A or R)
%G	Gap time
%H	Headway time
%L	Vehicle length (metres)
%S	Vehicle speed. If velocity is required use %+S to include sign
%T	Target number
%l	Target lane
%R	Target range
%U	Speed units M=MPH, K=KPH
%u	Length units M=metres F=feet
%X	Print a non-ASCII value. i.e to insert a STX character that has a value of 2 use %2X
%Z	Message checksum CRC8. Inserts a 2 digit hexadecimal number that is the CRC8 value of the proceeding characters.

Some of the above formatting characters the output can be adjusted to give the required length and tolerance. For instance, to report the speed to a tolerance of one decimal place and using a total of 5 characters use:

%5.1S

This type of notation can be used for the following formatting characters

%S, %R, %G, %H, %L

DATA RECORD MESSAGES

Data Record Messages

The radar constantly records per vehicle messages while turned on. Per vehicle messages are stored in data log files that can be downloaded from the radar.

Data log files are created at a rate of one per calendar day and the radar will store a **maximum of 30 days** worth of data (this equates to thirty log files). When the 31 log file entries are full, the radar will start again by overwriting the oldest log file.

Radar data records are reported in a format defined by a format string. The format string is entered using the command *DSRF command.

The format string can be used to control the output format of data record messages. The format string consists of the ASCII text that the user wishes to insert along with format specifiers, listed in the table on P37.

%t	Time downto milliseconds HH:MM:SS.SSS
%d	Date (dd/mm/yy)
%e	Epoch time 64bit hexadecimal milliseconds since 1st Jan 1970
%D	Target direction of travel (A or R)
%G	Gap time
%H	Headway time
%L	Vehicle length (metres)
%S	Vehicle speed. If velocity is required use %+S to include sign
%l	Target lane
%R	Target range
%U	Speed units M=MPH, K=KPH
%u	Length units M=metres F=feet
%X	Print a non-ASCII value. i.e to insert a STX character that has a value of 2 use %2X
%Z	Message checksum CRC8. Inserts a 2 digit hexadecimal number that is the CRC8 value of the proceeding characters.

An example of a format string is:-

Time=%t Speed=%5.1S%U Direction=%D%13X

Placing %13X is a way to put a carriage return on the end of the messages

Some of the above formatting characters the output can be adjusted to give the required length and tolerance. For instance, to report the speed to a tolerance of one decimal place and using a total of 5 characters use:

%5.1S

This type of notation can be used for the following formatting characters

%S, %R, %G, %H, %L

DATA RECORD MESSAGES

Data Record Messages Output Example

DS,04/02/19,15:11:08.769,00000168B91021E1R,554.3692,36156435,1,R,4.217231,12.50000,48.06149

DS,04/02/19,15:11:12.600,00000168B91030D8R,3.510108,3.813868,1,R,4.738761,12.98841,51.50910

DS,04/02/19,15:11:15.013,00000168B9103A45R,2.117878,2.438513,1,R,4.287929,13.60468,51.38296

The above shows three seperate data logs downloaded from a radar with all fields able to be downloaded, having been selected.

*Important to note is that the radar stores **ALL** parameters related to each vehicle. The option is available to just download the data of interest.

Troubleshooting

PHYSICAL INSTALLATION

If the unit is not operating correctly, please check the following, has the unit been:

1) Mounted within the recommended height of 6 metres?
2) Installed outside of the manufacturers specification?
3) Installed with any obstructions in the way of the beam?

ELECTRICAL INSTALLATION

If the unit is not operating correctly, please check the following:

1) Is power present at the unit?
2) Can you communicate with the unit?
3) Is there sufficient current to run the unit ?

CONNECTING / COMMISSIONING

If the unit is not operating in the prescribed manner, please check the following:

1) Can you communicate with the unit ?
2) Have the lanes you wish to detect been correctly set up?
3) Have you followed the AGD Align setup stages correctly and verified correct operation?

If trouble with operation persists please contact AGD Technical Support.

AGD TECHNICAL SUPPORT

eMail: technical@agd-systems.com

Tel: +44-1452 557404

Radar Characteristics

AGD **343**
HIGHWAYS MONITORING RADAR

OPERATING FREQUENCY BAND AND POWER

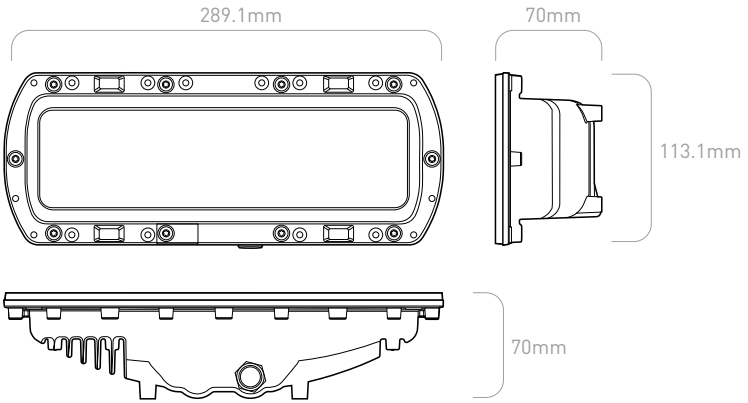
The radar frequency and power is as follows;

Parameter	Specified	Notes
Frequency Band	24.050 - 24.250GHz	
Centre Frequency (channel 1)	24.077GHz	
Centre Frequency (channel 2)	24.125GHz*	*Channel for USA & Canadian variant, Channel 2 - 24.125GHz.
Centre Frequency (channel 3)	24.175GHz	*Default channel for 343-500 model.
Centre Frequency (channel 4)	24.223GHz	
Frequency Modulation (FM)	45MHz	
Power	<100mW eirp	
Field Strength		
ITU Code	45M0FXN	

Technical Specifications

AGD **343**
HIGHWAYS MONITORING RADAR

PRODUCT DIMENSIONS



SPECIFICATIONS

Description	Highway Monitoring Radar
Technology	24GHz FMCW Radar
Mounting	Pole, portal gantry, MS3, MS4 or other structures
Mounting Height	6 metres nominal
Range	2-100 metres
Speed Range	5-250 kph
Housing Material	Black Polycarbonate / Aluminium
Sealing	IP56
Operating Temp	-15°C to +60°C
Power	6 W @ 24Vdc
Power Supply	12 - 24V dc
Configuration	AGD Align Setup Tool
Dimensions	W 113.1mm x D 70mm x L289.1mm
Radar Output	RS422
Weight	1400g
Approvals	ETSI EN 301 489 / BS EN 50293, ETSI 300.440, FCC CFR47 Part 15.245

Owing to the Company's policy of continuous improvement, AGD Systems Limited reserves the right to change their specification or design without notice.

RoHS COMPLIANT
Restriction on Hazardous Substances

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:
(1) This device may not cause harmful interference, and
(2) this device must accept any interference received, including interference, that may cause undesired operation. See 47 CFR Sec. 15. 19

A separation distance of at least 20 centimetres should normally be maintained between this product and the body of users or nearby persons.
Changes or modifications to this equipment, not expressly approved by AGD Systems Ltd, may void the user's authority to operate this equipment.

Certification

EU Declaration of Conformity

Certificate No: CE-076 Issue: 1

PRODUCT SOLUTIONS FOR
INTELLIGENT TRAFFIC SYSTEMS

AGD Systems
White Lion House, Gloucester Road,
Cheltenham, GL51 0TF, UK

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eMail: info@agd-systems.com
Web: agd-systems.com

We AGD SYSTEMS LTD
White Lion House
Gloucester Road
Staverton
Cheltenham
Gloucestershire
GL51 0TF
UNITED KINGDOM

as manufacturer hereby declare that the following product(s)

Equipment Model Type(s): 343-5xx-xxx

Equipment Description: Highways Monitoring Radar

conform with the provisions of the following EC Directive(s), including all amendments, and with national legislation implementing this / these directive(s):

2014/53/EU relating to Radio Equipment.

2011/65/EU RoHS Directive

and that the following harmonised standards and Technical Specifications have been applied:

EMC (Art 3.1(b)):	EN50293:2012
	EN301 489-51 V2.1.0
	EN301 489-1 V2.1.1
Health & Safety (Art 3.1(a)):	EN 60950-1:2006 +A1:2010 +A11: 2011 +A12:2011 +AC:2011 +A2:2013
	EN 50556:2011
	EN 62311:2008
Spectrum (Art 3.2):	EN300 440 V2.2.0
ROHS	EN 50581:2012

Notified Body Element Materials Technology 0891

EU type certificate EMT19RED1115

Signed Dated: 21/2/19

For and on behalf of AGD Systems Ltd
P M Hutchinson
Managing Director

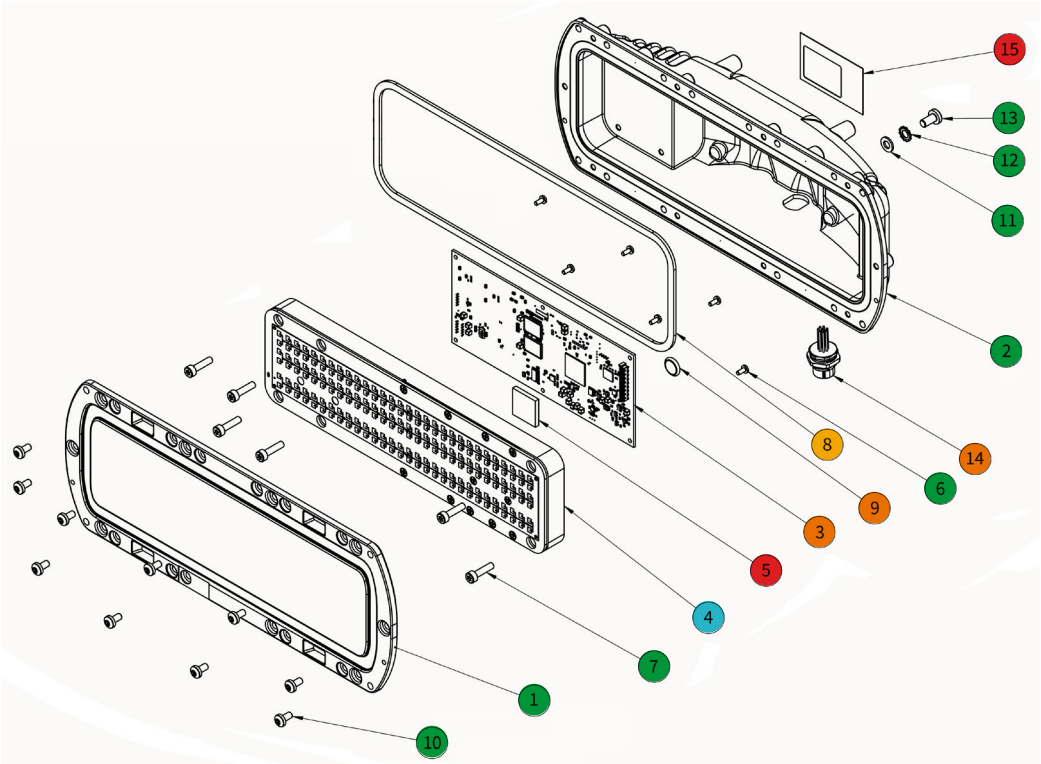
safer, greener, more efficient

Registered in England and Wales No. 2666988

End Of Life – Disposal Instructions (EOL)

343 HIGHWAYS MONITORING RADAR

AGD **343**
HIGHWAYS MONITORING RADAR



Item	Qty	Material
1	1	Polycarbonate
2	1	Powder Coated Aluminium
3	1	Mixed Materials
4	1	Mixed Materials
5	1	Silicon Resin Filled Ceramic Powder
6	6	Stainless Steel
7	6	Stainless Steel
8	1	Neoprene
9	1	Mixed Materials
10	10	Stainless Steel
11	1	Stainless Steel
12	1	Stainless Steel
13	1	Stainless Steel
14	1	Mixed Materials
15	1	Polyester

- Reuse / Recycle
- Separate & Recycle
- Downcycle
- Hazardous Recovery
- Non - Recyclable

This document serves as a guideline only for EOL procedures and further guidance may need to be sought from the appropriate authority or agency.

Important

SAFETY PRECAUTIONS

All work must be performed in accordance with company working practices, in-line with adequate risk assessments. Only skilled and instructed persons should carry out work with the product. Experience and safety procedures in the following areas may be relevant:

- **Working with mains power**
- **Working with modern electronic/electrical equipment**
- **Working at height**
- **Working at the roadside or highways**

1. This product is compliant to the Restriction of Hazardous Substances (RoHS - European Union directive 2011/65/EU).
2. Should the product feature user-accessible switches, an access port will be provided. Only the specified access port should be used to access switches. Only non-conductive tools are to be used when operating switches.
3. The product must be correctly connected to the specified power supply. All connections must be made whilst the power supply is off or suitably isolated. Safety must take always take precedence and power must only be applied when deemed safe to do so.
4. No user-maintainable parts are contained within the product. Removing or opening the outer casing is deemed dangerous and will void all warranties.
5. Under no circumstances should a product suspected of damage be powered on. Internal damage may be suggested by unusual behaviour, an unusual odour or damage to the outer casing.
   Please contact AGD for further advice.
6. This device complies with part 15 of the FCC Rules.

   • Operation is subject to the following two conditions:

   (1) This device may not cause harmful interference, and
   (2) This device must accept any interference received, including interference that may cause undesired operation.

   • This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. End users must follow the specific operating instructions for satisfying RF exposure compliance such that the module should not be installed in equipment intended to be used within 20cm of the body.

   • The transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

   • Changes or modifications not expressly approved by AGD Systems Ltd could void the user's authority to operate the equipment.
7. This Product is Compliant with the European Radio Equipment Directive 2014/53/EU.
   There is no restrictions of use within any EU Member state for this product.
   This product is Receiver Category 2.
8. Indicates compliance with all applicable Australian ACMA technical standards and associated record-keeping (including testing) arrangements.

IMPORTANT INFORMATION

Low Power Non-Ionising Radio Transmission and Safety

Concern has been expressed in some quarters that low power radio frequency transmission may constitute a health hazard. The transmission characteristics of low power radio devices is a highly regulated environment for the assurance of safe use.

There are strict limits on continuous emission power levels and these are reflected in the testing specifications that the products are approved to. These type approval limits are reflected in the product specifications required for a typical geographic area such as those for the EU (ETS300:440), for the USA (FCC part 15c) and for Australia/New Zealand (AS/NZS 4268). The limits adopted in these specifications are typically replicated in many other localized specifications.

The level of safe human exposure to radio transmission is given by the generally accepted guidelines issued by the International Commission on Non-Ionizing Radiation Protection (ICNIRP). This body has issued guidance for limiting exposure to time-varying electric, magnetic and electromagnetic fields (up to 300 GHz) which are quoted below.

	Radar and ICNIRP limit comparison			Typical Informative Limits for Radar Transmission Approval		
	Radar Transmitted Level (Note 4)	ICNIRP Limit (Table 6)	Exposure Margin	ETS300:440	FCC (part15c)	AS/NZS 4268
Power (mW EIRP)	<100mW (<20dBm)	N/A	N/A	100mW (20dBm)	1875mW (Note 1)	100mW (20dBm)
Max Power Density (mW/cm2)	3.18µW/cm2 at 50cm (Note 3)	<50W/m2 (5mW/cm2) (Note 2)	0.064%	N/A	N/A	N/A
Field Strength (V/m) at 3m	<0.58V/m (5.8mV/cm) (Note 1)	<137V/m (1370mV/cm)	0.42%	0.58V/m (5.8mV/cm) (Note 1)	2500mV/m (25mV/cm)	0.58V/m (5.8mV/cm) (Note 1)

Note 1 Values are calculated conversions for comparison purposes.

Note 2 Other equivalent limits include; Medical Research Council Limit of 10mW/cm2, IACP limit of 5mW/cm2 (at 5cm) and UK CAST limit of 5mW/cm2. . Power density at the radome typically 4µW/cm2. .

Note 3 Calculation is made on the assumption antenna is a point source therefore the actual value is likely to be significantly less than that quoted. Note that a theoretical max level at a 5cm distance (which gives 0.318mW/cm2) is at a point in the field where the radar beam is not properly formed.

Note 4 Comparison for product model 343 operating in the band typically 24.050GHz to 24.250GHz

From the table it can be seen that it is extremely unlikely that a potentially hazardous situation could occur owing to the use of such low power devices.

It is considered to be good practice not to subject humans to radiation levels higher than is necessary. In a works environment where multiple equipment on soak test are to be encountered then it is considered good practice to contain the equipment in an appropriate enclosure lined with radar absorbing material.

Notes

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Disclaimer

While we (AGD Systems) endeavour to keep the information in this manual correct at the time of download or print, we make no representations or warranties of any kind, express or implied, about the completeness, accuracy, reliability, suitability or availability with respect to the information, products, services, or related graphics contained herein for any purpose.

Any reliance you place on such information is therefore strictly at your own risk. In no event will we be liable for any loss or damage including without limitation, indirect or consequential loss or damage, or any loss or damage whatsoever arising from loss of data or profits arising out of, or in connection with, the use of this manual.

WARRANTY

All AGD products are covered by a 12 month return to factory warranty. Products falling outside this period may be returned to AGD Systems for: evaluation, repair, update or re-calibration, any of which may be chargeable.

PRODUCT SOLUTIONS FOR
INTELLIGENT TRAFFIC SYSTEMS

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THE TRAFFIC GROUP
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